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Water transfers in Arizona: Measuring effects on areas of origin

Checchio, Elizabeth, M.S.
The University of Arizona, 1990
WATER TRANSFERS IN ARIZONA:
MEASURING EFFECTS ON AREAS OF ORIGIN

by

Elizabeth Checchio

A Thesis Submitted to the Faculty of the
DEPARTMENT OF HYDROLOGY AND WATER RESOURCES

In Partial Fulfillment of the Requirements
For the Degree of

MASTER OF SCIENCE
WITH A MAJOR IN WATER RESOURCES ADMINISTRATION

In the Graduate College
THE UNIVERSITY OF ARIZONA

1990
STATEMENT BY AUTHOR

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ACKNOWLEDGEMENTS

I want to thank Susan Christopher Nunn for the opportunity to share with her the discovery of something interesting in all of this and for her almost endless availability to talk and think and explore.

I also wish to thank Don Davis for his confidence in my independence; Gary Woodard for the nearly constant flow of information and rumors and for his ability to recognize when the numbers just don't make sense; and Bonnie Colby for her organizational, promotional, and moral support.

I also want to acknowledge the Ford Foundation and the Kellog Foundation, whose grants helped to support this study.

Finally, I want to thank Steven J. Shupe for his example of excellence, and Pamela Calla, for not letting me lose sight of what is important in the world.
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ABSTRACT

Thousands of acres of irrigated farmland in rural Arizona have been purchased recently with the hope of transporting the associated water to cities. Many Arizonans believe that this "water farming" can solve Arizona's water supply problems. Others, however, fear that water transfers will have serious adverse effects on the areas of origin. To evaluate the effects of transfers, their path must be traced through the regional economy and environment. This requires sophisticated modeling and detailed data. It is possible, however, to make interregional comparisons with much less data, contrasting regional sensitivity to particular categories of effects. The most important are economic, fiscal, environmental, and limitations on future development potential. In this research, indices of relative sensitivity to economic and fiscal effects of water farming are constructed based on readily available secondary data. The values for these indices are calculated for four Arizona counties: La Paz, Maricopa, Pima, and Pinal.
CHAPTER 1

INTRODUCTION

The Phenomenon

Numerous factors are combining to create unprecedented pressure to transfer water in the western United States. The explosive growth of western cities and industrial expansion, a depressed agricultural economy, increased opposition to the environmental effects of new dams, limited federal funds to subsidize water development, and the quantification and development of Indian water rights all contribute to increased competition for finite water supplies. Western water is currently being bought, sold, leased, exchanged, borrowed during droughts, and "banked" for future use.

Water transfer, as the term is used here, means a change in ownership of the right to use water. Such transfer of entitlements may eventually involve the physical withdrawal and transport of the actual water. Water transfers in the western United States take various forms, many of which involve voluntary arrangements between willing parties. These transfers may entail the permanent sale of an entitlement, the lease of a water right for a specified period of time, or the right to use a water entitlement during dry years only. Other transfers involve exchanging one water supply for another, either to avoid the costs of physically moving water, or perhaps to match water supplies of varying qualities with appropriate uses. These types of arrangements, which often provide the flexibility needed to effectively manage water resources, are common in the West.
Most western states, including Arizona, have procedures for changing the purpose and location of water use; many also have procedures for changing the point of withdrawal. These procedures are designed to guarantee that other water users with vested rights are not damaged by the change. Some states allow a water right to be severed from the land and sold separately. In Arizona, however, most water rights cannot be sold separately; they are "appurtenant" to the land. This often means that one must buy land in order to acquire water.

Land purchased primarily for its appurtenant water is called a "water farm" or "water ranch." Because agricultural water rights in Arizona are appurtenant to the land, acquiring water rights that originally were established through applying water to crops commonly involves purchasing irrigated farmland. The actual water may then, under certain conditions, be removed from the land to a new place and purpose of use. In areas of the state where quantified groundwater rights do not exist, landowners have a virtually unlimited right to pump water underlying their land. In these instances, purchasing large tracts of land provides access to the water and reduces or eliminates competing withdrawals by neighboring pumpers from the same aquifer.

Most municipal water providers in Arizona currently rely on a combination of groundwater, imported Colorado River water, and/or other surface waters for their water supplies. Anticipating that these sources will prove insufficient to meet projected demands, water providers are turning to water transfers for an abundant source of relatively low-cost water. Tens of thousands of acres of irrigated farmland
in rural parts of the state have been purchased over the past few years, not for the value of the land but for the water that goes with the land (Checchio, 1987). The new owners of these water farms intend eventually to transport the associated water to areas of the state with growing water demands. Arizona's Groundwater Management Act (GWMA), through its efforts to curtail declining groundwater levels, is primarily responsible for this new interest in rural lands. Burgeoning urban populations and economically depressed conditions in agriculture also contribute to this growing phenomenon. The nearly complete Central Arizona Project (CAP) aqueduct, running from the Colorado River through prime irrigated agricultural land and then into central Arizona, provides a possible means of transporting water from rural areas of origin to the state's two metropolitan centers.¹

The Policy Issue

Water farming is generating increased discussion and debate throughout the state. Many view it as a solution to Arizona's water supply problems by providing the means to transfer the state's limited water supplies to areas of greatest need. The potential of water farming to fulfill this promise is presently being explored by various interests. Municipalities, developers, speculators, and others have identified attractive water farm acreage, spent significantly more than $100 million to purchase

¹ The Central Arizona Project is a massive federal reclamation project costing in excess of $4 billion featuring a 335-mile long aqueduct that, when complete in the mid-1990s, will have the capacity to move up to 2.1 million acre-feet of water per year from the Colorado River to urban areas and farms in central Arizona.
farmland and raw desert, and devised strategies for transporting the water. Additional water farm purchases continue to be made.

In many instances, water transfers raise concerns about adverse effects on areas from which the water is taken, damage to other water right holders, impaired water quality, and maintenance of instream flows for fish, wildlife, and recreation. Discussion in Arizona has focused on several types of consequences resulting from water farm purchases in the areas of origin. Some of these adverse effects occur when the purchase occurs; others occur when the agricultural land is retired from production; and still others when the water is actually transported out of the area.

Fiscal impacts, including the loss of property tax base and bonding capacity, tighter spending limitations, and impacts on revenue sharing, occur immediately upon the land being purchased by a municipality or other tax-exempt entity.

Environmental and direct economic impacts occur when farmland is retired. Environmental impacts include soil erosion, blowing dust, and tumbleweeds. Direct economic impacts include the loss of farm sector jobs and income. Indirect economic impacts occur after that, as businesses that provide goods and services to farmers are affected. These include, for example, seed, fertilizer, and agricultural chemical suppliers, farm equipment dealers, gins, and crop dusters. Eventually, all businesses in the area, including retail shops and restaurants, are affected by the general economic decline.

Further environmental effects may occur when water is transported away from the area of origin, and could include degraded water quality, loss of riparian habitat,
and fissuring and subsidence. **Future economic development** in the area of origin is threatened both when the water farm purchase is made and when the water actually leaves the area. When the tax base shrinks, local services decline, and water and land are tied up in water farms, the area of origin may become unattractive to businesses looking to locate new plants. A subtle but deleterious effect on the area of origin is the loss of local self-determination, as key decisions affecting the future of the area are moved beyond the control of its residents.

Over the last five years, nearly every legislature and judicial system in the West has addressed policy issues involving transfers of water. State policy makers have struggled with questions such as: Are important interests threatened by water transfers? If so, what kinds of communities are most vulnerable and how might they be protected? Do the potential benefits to the state's urban centers outweigh the threats posed to rural communities by water transfers? If so, should transfers be encouraged or might there be other compelling considerations? In general, what is the appropriate role of state government in the water transfer process? Arizona policy makers currently are grappling with the problem of protecting areas of origin from the negative impacts of water farming without denying metropolitan areas necessary water resources. Similar questions are being raised everywhere that water is being transferred, and state legislatures are responding with creative solutions around the West.
Literature Review


Until recently, most economic analyses of transfers of water out of irrigation found the economic impacts to be minimal and were far outweighed by the benefits associated with the water in its new use. Challenging the conventional wisdom that irrigation has been an important source of regional growth and that removing water from agriculture would have significant negative economic effects, these authors argued the contrary "limited impact" hypothesis. (Young, 1984; Kelso, Martin, and Mack, 1973). Their approach was to compare the reductions in net farm income and in regional farm-related income and employment from potential reallocation with the gains in those variables in the receiving sectors. Highlighting the relatively low economic value of irrigation water at the margin, Young (1984) concluded that the value of water in its new use generally would be five to ten times that of its value in agriculture. Likewise, he concluded that indirect losses associated with transferring
water from agriculture, while not insignificant, would be dwarfed by the gains in the non-agricultural sector.

Kelso, Martin, and Mack (1973) demonstrated that regional income and employment linkages have become quite modest. The transformation has occurred because of the increasingly capital intensive nature of modern irrigated crop production—fewer workers require fewer local services—and the tendency to import a growing portion of farm production inputs from distant sources.

An underlying assumption of these earlier agricultural models which predicted minimal economic impacts was that water transferred out of agriculture comes from the low-value margin of application, e.g. from forage crops or feed grains (see Young, 1984; Gardner, Young, and Conklin, 1984; Mapp, 1972). This important assumption was challenged by Nielsen (1986), who demonstrated that this is not the characteristic pattern of water transfers from agriculture. Nielsen documented that the water typically is being sold in large blocks of senior water rights that historically have been applied to the best agricultural lands, usually growing the higher-valued crops. This pattern reflects the importance of the seniority of a water right purchased for municipal and industrial use.

Furthermore, these earlier models predicted that the rate of loss of irrigation water would be relatively slow, allowing a comparably long time for affected sectors to plan and adjust, supporting the conclusion that no special policies are needed to protect rural communities from these changes (Young, 1984). However, given the
typically high transportation and transactions costs, these purchases tend to be concentrated temporally and geographically (Nunn, 1988; Nielsen, 1986).

While economic analyses traditionally focus on efficiency, others have examined the non-efficiency goals of water institutions (Maass and Anderson, 1978; Brown, et al., 1982). Mumme and Ingram (1985) stressed the importance of water in promoting a community's sense of control and well being. They argued, for example, that for certain Native American and Hispanic communities in the southwestern U.S., markets for water "can only diminish what control these communities presently have over their water resources and erode their viability as culturally distinct societies" (p. 379). Their point becomes the basis of a critique of the expanded water market system advocated by the "New Resource Economics" (Anderson, 1983). More generally, it has been demonstrated that security and control over one's water supply is highly valued, over and above its direct economic significance (Nunn and Ingram, 1988; Maass and Anderson, 1978). Sax (1984) examined the blank space in American law regarding the rights of communities to be compensated for any other than economic losses.

Others have explored the basis for area-of-origin compensation and explored the criteria for economically efficient transbasin diversions, concluding that to ensure economic efficiency the analysis must not ignore third-party effects of transfers (MacDonnell and Howe, 1986; MacDonnell, Howe, Corbridge, and Ahrens, 1985). Nunn and Ingram (1988) analyzed the comparative abilities of the various water institutions to develop and weigh information about indirect and nonuser impacts of
water transfers, concluding that the appropriate forum depends on our priorities among values and the particular values that are at stake in specific issues.

**Goals and Methodology**

Goals

Although much of the published literature has characterized the types of third-party effects which might result from transfers and suggested compensation or mitigation measures, few attempts have been made to evaluate the seriousness or measure the magnitude of the impacts. Rigorous quantification of the effects of a change in a regional resource base involves the construction of a costly and data-intensive econometric model, an input/output model, or an export-base model relying on surveys. In addition, complex hydrologic models would be required.

A method of assessing the extent of potential damage to areas of origin caused by water transfers that uses readily available data would enable policy makers to target scarce research resources to areas of high vulnerability. The goal of this research is to develop such a method.

Methodology

This is accomplished by analyzing the driving forces behind water transfers in Arizona and the West and gathering data on all water farming transactions and activities in the state. The legal environment in which water transfers occur in Arizona is examined, along with the associated transportation and transactions costs.
Next, the various categories of effects of water transfers on areas of origin—economic, fiscal, environmental, and limitations on future development—are identified and discussed. This is followed by a review of the transfer issue's legislative history in Arizona and a comparative analysis of how other western states attempt to regulate interbasin transfers. Finally, indices are developed which measure the relative sensitivity of four Arizona counties—La Paz, Maricopa, Pima, and Pinal—to the economic and fiscal effects of water transfers.

This research does not seek to quantify or forecast the actual changes to a county's economic or fiscal capacity in response to water farming; instead, it attempts to measure the relative changes among counties. To emphasize the relative nature of the measure, it is expressed as an index. This involves constructing a ratio, wherein the value for the particular characteristic of each county is divided by the value for the base case (in this instance, Pima County).

Whereas neoclassical economics advocates assessing the benefits and costs to whomever they accrue, a narrower regional viewpoint is taken in constructing these indices. This is done in order to evaluate the distributional consequences associated with water transfers on areas of origin. Prior to constructing the indices, it was necessary to identify the determinants of a region's sensitivity or vulnerability to the various categories of potential effects.

**Economic index.** A two-part index is created to assess the counties' sensitivity to economic effects using county incomes as a measure of economic vitality. The two elements of the index are:
(1) a measure of the relative sensitivity of total county incomes to declines in agricultural acreage (i.e., diversity of the local economy); and

(2) the percentage of the county's total agricultural acreage being considered for water farming.

The combination of these two elements yields a county's overall sensitivity to the economic effects of water farming activity relative to the other counties indexed.

The economic index is derived from the following basic equations:

\[
\frac{\text{County Income from Ag and Ag-related Sources}}{\text{Total County Income}} \quad (1A)
\]

\[
\frac{\text{Total Water Farm Acreage}}{\text{Total Cultivated Acreage}} \quad (1B)
\]

\[
\frac{\text{County Income from Ag and Ag-related Sources}}{\text{Total County Income}} \times \frac{\text{Total Water Farm Acreage}}{\text{Total Cultivated Acreage}} \quad (1C)
\]

The results are divided by the value for Pima County, yielding an index which may be used to compare the degree of shock to a regional economy represented by the retirement of agriculture and the transfer of irrigation water.

**Fiscal index.** For direct fiscal impacts a similar index is created which measures a county government's sensitivity to the removal of agricultural acreage from its tax base. This contains the following elements:
(1) the percentage contribution of agricultural lands to the county's total tax base;

(2) the percentage contribution of municipally owned water farm acreage to total agricultural acreage.

The combination of these two elements yields the overall sensitivity of a county's tax base to municipally owned water farms.

Because a county's total revenue is derived from sources other than taxation, a final part of the fiscal index considers the percentage contribution of municipally owned water farms to the county's total revenue.

The following basic equations were used in constructing the fiscal index:

\[
\frac{\text{Valuation of Ag Properties}}{\text{Total Valuation of County}} \quad (1D)
\]

\[
\frac{\text{Valuation of Municipal Water Farms}}{\text{Valuation of All Ag Properties}} \quad (1E)
\]

\[
\frac{\text{Valuation of Ag Properties}}{\text{Total Valuation of County}} \times \frac{\text{Value of Municipal Water Farms}}{\text{Value of All Ag Properties}} \quad (1F)
\]

The economic and fiscal indices combined provide a basis for developing appropriate policy responses to controversial water transfers. Further research in this area could involve the development of similar indices for environmental and future development potential effects.
CHAPTER 2  
THE DRIVING FORCES BEHIND WATER TRANSFERS 

West-wide Pressures

Understanding Arizona’s water farming phenomenon requires an appreciation of the forces driving water transfers in the West, in general, and in Arizona, in particular. In the past, new water demands were usually satisfied through large-scale federal water projects. During the era of the big water project, we looked towards structural solutions to water shortages—towards huge conveyance and storage facilities. These projects were subsidized by the federal government to the extent that direct beneficiaries of projects constructed in the 1950s and 1960s typically bore about 30 percent of project costs (Woodard et al., 1988). The costs of water development projects have risen as the best reservoir sites have been used, and environmental considerations prompt litigation, project delays, and costly impact studies. Local share of costs has risen, too, as the federal government, with its budgetary constraints, is no longer willing to subsidize project costs to the extent it did in the past. The Central Arizona Project, expected to deliver 1.2 million acre-feet of Colorado River water annually, is likely to be the last large federally funded water project. At the same time, there is widespread recognition that many of the groundwater basins of the arid West are in a serious overdraft condition, and some states have set limits on new groundwater pumping.

Confronted with the reality of finite water supplies, the West is entering into a new era of water management. As expanding municipalities and industrial
development compete with agriculture for limited water supplies, water resource managers are increasingly turning to non-structural solutions—to water conservation, water reuse, and most of all, to water reallocation. Because existing water supplies in the West are for the most part fully claimed, the satisfaction of new demands for water often means that water be moved from lower-economic-value to higher-economic-value uses. Given that irrigated agriculture accounts for more than 80% of total water consumption in the West, and that economic returns to agriculture are relatively low, water in the West is shifting away from the agricultural sector and into expanding municipal and industrial uses. In 1987, for example, approximately 75% of the water transfers that occurred in the Southwest went from agricultural use to municipal and industrial uses.2

Characteristics of Western Water Transfers

Water transfer, as used here, means the reallocation of the right to use water. Such transfer of entitlements may eventually involve the physical withdrawal and transport of the actual water as well. Water transfers in the West take many forms, most of which involve voluntary arrangements between willing parties. Such transfers may involve the permanent sale of an entire entitlement, the lease of a water right for a specified period of time, or the right to use a water entitlement during dry years only.

2 Water Market Update, Vol. 1, 1987
Examples of these types of arrangements abound in the West, often providing the flexibility needed to make efficient use of available water resources. One such arrangement involves a Utah city which paid $25,000 to a nearby farmer for the option to lease a senior irrigation right. In dry years, when the option is exercised, the city also provides the farmer with 300 tons of hay and an additional $1,000.³ The City of Albuquerque has a program wherein water from the San Juan-Chama project, not as yet needed by the city, is leased for a fixed term. Revenues from the lease program are used to repay project costs to the Bureau of Reclamation (Shupe, Weatherford, and Checchio, 1989).

Other innovative strategies involve exchanging one water supply for another. Such exchanges most commonly occur in order to avoid the costs of physically moving water, while others are aimed at matching water supplies of varying qualities with appropriate uses. Water exchanges are common in the Colorado Front Range, for example, where transmountain tunnels and ditches provide flexibility in delivering water between the Colorado, South Platte, and Arkansas river basins. Complex paper exchanges allow water purchased in one basin to be available to users in another basin, while avoiding high transportation costs (Ibid.).

Of the various ways described for reallocating water in the West, the outright purchase of water rights is by far the most common. Although the formalities differ among political jurisdictions, the prevailing rule in the West is that most water rights

may, with state agency or court approval, be sold and transferred to a new point of use. Such transfers may include changes in type and location of use and in the point of diversion, as long as the change does not adversely affect other water right holders. Exceptions to this rule exist, but even with constraints to water marketing in some states, the permanent sale and transfer of water rights occurs widely throughout the West (Ibid.).

Indian Water Rights

In 1908, the Supreme Court granted Indian tribes legal entitlements to enough water to meet the needs for which reservations were set aside.\(^4\) At a minimum, these rights go back to the date when the reservations were established and, therefore, are senior to most rights granted under state law. Many tribal water supplies, though secure, exist only on paper, and most tribes lack the capital needed to develop their "paper rights" into reliable water supplies. To raise capital for water projects and other economic development, some tribal councils are assessing the short-term lease of water to off-reservation users. Similarly, off-reservation municipalities and other water users with growing demands are studying the potential benefits of incorporating reliable, leased Indian water into their supply picture.

There is much legal uncertainty, however, regarding the marketability of Indian water rights. Although tribes commonly lease water to non-Indians for use on the reservations, congressional approval is generally needed for Indian water to

be marketed and transferred for use off the reservation. Such approval has only been granted in a very limited number of cases.

**Southern Arizona Water Rights Settlement Act.** Congressional approval was granted for the water allocated under the Southern Arizona Water Rights Settlement Act of 1982 (SAWRSA). SAWRSA provided that the Tohono O'odham Indian Nation (formerly the Papago Tribe) could sell water from several sources to Tucson area users subject to approval by the Secretary of the Interior.

The CAP is scheduled to start delivering Colorado River water to Tucson in 1991 and to the Tohono O'odham reservation south and west of Tucson by 1992. The Tohono O'odham Nation is currently assessing its options for using the CAP water. These options include recharging the water for future use, opening reservation lands to new irrigation, applying it to agricultural lands retired from irrigation by Tucson in the Avra Valley, and leasing a portion of the entitlement to local water users.

In addition to potential marketing provisions allowing Indian nations to lease their water entitlements for off-reservation use, water transfers have been an important component in providing water to satisfy Indian water entitlements, and may play an even bigger role in future settlements. In these days of federal austerity,

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5 Under the Indian Nonintercourse Acts dating back to 1790, tribes may be constrained from leasing or selling their water rights off-reservation without congressional consent [25 U.S. Code, Section 177].

state and federal negotiators are eager to explore alternative ways to generate the funds that may be needed to implement Indian water rights settlements.

**Ak-Chin Water Rights Settlement Act.** The Ak-Chin Water Rights Settlement Act of 1978 authorized development of groundwater supplies for the Ak-Chin Tribe from nearby federal lands. This source proved insufficient, however, and in 1984 the Act was revised to provide for the transfer to the Ak-Chin Indian Community of 50,000 acre-feet of Colorado River water previously allocated by Act of Congress to the Yuma-Mesa Division of the Gila Project. The Yuma-Mesa Division successfully negotiated to receive, as compensation for its cooperation in the deal, $9.4 million for repairs and improvements within the Division and for an amendment to the delivery contract to allow for the sale of 17,500 acre-feet of agricultural project water to domestic users. The Division was also discharged of its responsibility to repay project costs owed to the Bureau of Reclamation, saving the Division $2 million.

The U.S. Department of Interior currently favors negotiated settlements and has negotiating teams formally meeting with Indian tribes, states, and local non-Indians to discuss tribal water rights, including the possible role that water leasing

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8 Pub. L. No. 98-530.

may fill in formulating settlements.\textsuperscript{10} Most recent settlement negotiations involved a water marketing option of some sort. Nevertheless, such provisions remain controversial and have encountered stiff opposition.\textsuperscript{11}

\textbf{Salt River Pima-Maricopa Indian Community Water Rights Settlement Act.}

More recently, following years of negotiations, the Salt River Pima-Maricopa Indian Community Water Rights Settlement Act was signed into law in October 1988.\textsuperscript{12} Under the settlement, the Salt River Pima-Maricopa Indian Community will lease its 13,300 acre-feet annual CAP entitlement to Phoenix-area cities for a lump sum payment of $16 million. The lease is scheduled to run from January 1, 2000, through 2098. Furthermore, the cities are putting up $9 million to purchase 22,000 acre-feet of senior Colorado River water rights for delivery to the Indian Community.\textsuperscript{13}

These two marketing concepts were in the bill when it was introduced in March 1988, although the federal government was originally going to pay for the Colorado River rights, and only Phoenix, rather than a consortium of six municipalities, would lease the CAP water from the Tribe. The proposed settlement bill was modified after the

\textsuperscript{10} The Western Governors Association and the Conference of Western Attorneys General also support the policy of seeking negotiated settlements to Indian water right disputes. See \textit{Water Market Update}, Vol. 1, Oct. 1987, p. 9, and Vol. 1, Sept. 1987, p. 12.


federal government objected to what they felt was a disproportionate share of the settlement costs.

San Luis Rey Indian Water Rights Settlement Act. Marketing provisions also were included in the San Luis Rey Indian Water Rights Settlement Act, which passed by Congress in October 1988.\textsuperscript{14} When the San Luis Rey bill was originally introduced in 1987 to settle water disputes between five Indian Bands north of San Diego and local non-Indian users, it authorized the Bands to use, lease, sell, or exchange their water off the reservation, with any contracts subject to approval by the Secretary of the Interior as trustee.

This provision allowing for off-reservation marketing was eliminated in the final version of the bill. However, language in the bill allows the Bands and the local water entities to enter into an arrangement in which the entities may lease the Bands' 16,000 acre-feet of "supplemental water"—water developed and imported from public lands within California—as part of the settlement agreement.\textsuperscript{15}

Colorado Ute Indian Water Rights Settlement Act. Marketing provisions in the Colorado Ute Indian Water Rights Settlement Act \textsuperscript{16}, passed by Congress in 1988, also went through several modifications. The original bill authorized the lease, sale, or exchange of Tribal waters for 50-year terms, subject to approval by the Secretary of the Interior. The specific marketing provisions were later struck from


the bill and replaced with a simple waiver of the Indian Nonintercourse Act. The waiver would remove any congressional restrictions of off-reservation marketing by the Colorado Ute Tribes, but leave unresolved issues of how interstate compacts, past court decisions, and other components of the law of the Colorado River might influence off-reservation leasing. Further language was later added to provide that any Ute water marketed off-reservation would lose its character as part of a reserved water right and "shall become a Colorado State water right during use of that right off the reservation fully subject to State laws, Federal laws, interstate compacts, and international treaties", subjecting a leased water right to forfeiture for non-use and other provisions of state law.\textsuperscript{17}

Role of the Federal Government

In addition to the responsibility of satisfying Indian water right entitlements, the federal government is increasingly finding itself involved with individuals and entities wanting to market federally supplied water or to use federal reservoirs and canals to facilitate private transfers. Consequently, the Bureau of Reclamation, as operator of the major reclamation projects in the West, is currently shifting its role from water project constructor to water resource manager. Realizing that water marketing could play an important role in increasing the efficiency of existing projects, the Bureau is in the process of establishing more flexible strategies for

\textsuperscript{17} Water Market Update, Vol 2, No. 11, 1988.
marketing federally developed water and handling increased supplies made available through water conservation efforts.

In December 1988, the Department of the Interior issued a statement expressing the Interior's intent to support water marketing and "to afford maximum flexibility to state, tribal, and local entities to arrive at mutually agreeable solutions to their water resource problems and demands." The statement sets forth policies which will guide the department's involvement in water transfers. The Dept. of the Interior will become involved in facilitating transfers in cases where no diminution of service to other federal contractors would result, and project repayment would not be impaired. It will further consider transfers proposed between willing buyers and sellers, provided that third-party water right holders are not injured by the transfer and that the necessary attention is given to mitigation of any adverse environmental effects. Furthermore, the policy states that primacy in water allocation and management decisions rests principally with the states and that voluntary water transactions under this policy must be in accordance with applicable state and federal laws (Marchant, 1987).

The participation of the federal government in water transfers has already occurred in some instances. As mentioned earlier, the Ak-Chin Settlement Act

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allowed the Gila Project's Yuma-Mesa Division, consisting of three irrigation districts, to sell 17,500 acre-feet of their agricultural water delivery to domestic users. This was an unusual circumstance, however, as the sale was necessary for the federal government to meet its obligations to the Ak-Chin Indian Community.

A more recent instance that marks a new emphasis on water marketing in Bureau of Reclamation policy occurred in September 1987, when the Bureau amended contracts to transfer federal project water from agricultural to industrial uses in central Utah. Utah Power & Light (UP&L) agreed to pay for the delivery of 2,576 acre-feet per year from the Bureau that had previously been allocated to irrigation companies within the Emery Water Conservancy District. UP&L paid $2.92 million for the right to receive the water from the Bureau for as long as the Emery County Project is operable. This money covers Emery Water Conservancy District's repayment obligation owed to the Bureau and also includes payments to the Bureau for capital cost recovery and interest on the initial federal investment.  

Driving Forces in Arizona

In addition to the forces acting west-wide, several factors are driving recent water farm purchases in Arizona. Chief among these is the 1980 Groundwater Management Act, with its assured water supply and safe yield provisions. Other factors include the continued rapid growth in Arizona’s urban areas; a depressed agricultural economy; Indian water entitlements; and construction of the Central

Arizona Project aqueduct. While future water scarcity is an underlying concern, the need for "wet" water is not the primary motivator of water transfers.

The Arizona Groundwater Management Act

The primary driving force behind water farm purchases in Arizona is the 1980 Groundwater Management Act (GWMA). The GWMA provides incentives for Arizona municipalities to reach far into rural counties for secure water supplies to guarantee their future growth. The GWMA created the Arizona Department of Water Resources (ADWR) and established four Active Management Areas (AMAs) within which groundwater is being managed intensively to reduce groundwater withdrawals. (see Figure 1, Arizona's Active Management Areas). Approximately 80% of the state's population resides within these AMAs, and about 70% of water consumption occurs there (Ferris, 1986). The statutory management goal for the Phoenix, Tucson, and Prescott AMAs is to achieve safe yield by the year 2025. Safe yield for purposes of the statute means that groundwater withdrawals may not exceed groundwater recharge—in other words, the basin must become hydrologically "balanced." The Pinal AMA, with a primarily agricultural economy,


FIGURE 1. ARIZONA'S ACTIVE MANAGEMENT AREAS
has the goal of extending the life of the agricultural economy as long as possible consistent with the need to preserve water supplies for future nonagricultural uses.

Within AMAs, the GWMA prohibits new development where an assured water supply does not exist. Lands within an AMA may be offered for sale or lease only if the land is located within an area already designated as having an assured water supply or if a certificate of assured water supply is obtained from the Director of ADWR (the Director). This certificate is issued based on the continuous availability of sufficient water of adequate quality to meet the needs of the proposed use for at least 100 years. Furthermore, the proposed water use must be consistent with the management plan and achievement of the management goal for the AMA.

Within those AMAs which have safe yield as their goal, an assured water supply eventually may not be based on mining groundwater within AMAs. Consequently, the quantity of groundwater located within AMAs that can "count" toward an assured water supply will be limited to the amount being recharged into the aquifer. Cities and towns (but not private water companies) which have subcontracted to receive CAP water are deemed to have assured water supplies until

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27 Ibid. at $ 45-576(A).
28 Ibid. at $ 45-576(L)(1).
29 Ibid. at $ 45-576(L)(2).
the year 2001\textsuperscript{30}. At that time, the determination is subject to review by the Director. The uncertainty created by this provision drives many municipalities with seemingly adequate CAP supplies to obtain additional water rights outside of their AMAs.

The 1980 GWMA not only created a demand for water transfers, it helped create the supply as well, by making it easier to transport water from areas outside AMAs. Prior to 1980, neighboring pumpers harmed by transport of groundwater off appurtenant lands could sue for injunctive relief. The GWMA clarified the rights of landowners to pump and transport water off their land and limited relief of neighboring pumpers to suing for damages\textsuperscript{31}.

The virtual absence of restrictions on the withdrawal and transport of groundwater from lands outside AMAs stimulates interest in purchasing these lands for water farms. One can buy just enough land outside an AMA to build a well field and then withdraw and transport as much water as desired, as long as the water is applied to some "reasonable and beneficial use." Most water farm purchasers seek to avoid potential damage claims of damaged neighbors and precluding the possibility of competing pumpers by buying large tracts of land, in some cases, entire sub-basins or aquifers. This strategy has the added benefit of assuring that the purchasers still will be entitled to large quantities of water if at some future date their land is

\textsuperscript{30} Ibid. at \$ 45-576(I).

\textsuperscript{31} Ibid. at \$ 45-544.
included within a new AMA, because water rights within AMAs are based on historical pumping. Purchase of the entire farm also benefits the farmer, whose land has little economic value independent of its water.

It is not yet clear what quantity of water these purchases will contribute to the buyers' 100 years assured water supplies. In general, purchasers of reliable surface water rights will be credited with a quantity equal to their consumptive use right; purchasers of land overlying groundwater aquifers will probably be credited with estimated annual recharge to the aquifer plus 1/100 of the estimated groundwater stored to some particular depth. Most water farm purchases to date involve groundwater aquifers with insignificant recharge rates, meaning that what is available for transfer to urban areas is essentially non-renewable or "mined" groundwater.

Urban Growth

In the face of finite water supplies, Arizona municipalities continue to grow. Arizona's population has increased from about 0.75 million in 1950 to 2.7 million in 1980, with about 70% of that growth occurring in the Tucson and Phoenix metropolitan areas (Taylor and Woodard, 1984). It has been projected that nearly 6 million people will reside in Arizona's urban centers by the year 2025.

Some observers claim that Arizona's urban demand has essentially been satisfied by the water farm purchases that have already been made; others disagree.

Wes Steiner, the first director of the Arizona Department of Water Resources, announced in October 1987 that central Arizona cities were still 100,000 acre-feet per year short of meeting their 2025 water needs. He recommended that the cities buy 400,000-500,000 acre-feet/year of water rights during the next decade to support future growth. Steiner's speech was followed by a flurry of speculative purchases of land associated with water in La Paz County. During the following month, options were taken on approximately 47,000 acres of land overlying groundwater (Nunn, 1988).

Depressed Agricultural Economy

In Arizona, irrigated agriculture accounts for about 85% of total water consumption but contributes only 2% of state income. A number of factors have caused a decline in the agricultural sector of Arizona's economy. As a result, farmers in distressed financial positions form a pool of willing water farm sellers. Periods of hardship in agriculture are a recurring phenomenon, however, and an economic upturn in the sector should occur eventually.

Indian Water Entitlements in Arizona

Indian tribes presently hold a significant quantity of water rights in the lower Colorado River Basin. In addition to these quantified rights, Arizona tribes may be...

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33 See "The Ball is in Your Court", a speech presented by Wes Steiner at a meeting of the Arizona Water Commission in Phoenix, Arizona on October 15, 1987.
awarded additional entitlements to surface and, possibly, groundwater by the courts in the Gila and Little Colorado river general adjudications. Thus, it is possible that Arizona Indian tribes could eventually hold entitlements to a major share of the state's available water supplies. These entitlements to sizable quantities of senior water rights virtually guarantee Indian tribes a key role in the future water supply picture in Arizona.

The CAP Aqueduct

The CAP aqueduct offers a potentially cheap and reliable means to transport vast quantities of water from rural to urban areas of the state, allowing the supply and demand of water to meet. However, many important details are uncertain, such as the amount and distribution of excess aqueduct capacity over time and the terms and conditions under which the Central Arizona Water Conservation District (CAWCD), the operator of the CAP, will make this capacity available to transferrors. A fuller discussion of this topic is found in Chapter 5 (Water Transfer Costs).

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34 A general adjudication is a court action to determine the type, amount, and priority date of every user's water right in a particular watershed. The adjudication proceedings, now in progress, include all water uses within the state, with the exception of uses along the Colorado River. Potential awards to Indian tribes could range upwards to more than a million ac-ft annually.
CHAPTER 3
WATER FARMING ACTIVITY IN ARIZONA

Arizona's Early Transfer History

Water transfers occurred in Arizona as early as 1948, when the City of Prescott purchased farmland in the nearby Chino Valley. The city developed a well field on the land and began pumping water for domestic use in Prescott. The transfer proved controversial from the start, as local farmers charged that the pumping by Prescott exceeded that normally needed for agriculture, leading to water level declines in the basin. In the early 1970s, a lawsuit was filed on behalf of local water users to limit Prescott's pumping. Litigation continues today.

Water farming activity also took place in Arizona in the early 1970s. Beginning in 1971, the City of Tucson began purchasing and retiring farmland in the Avra Valley, located about 15 miles northwest of Tucson.

While these purchases initially caused considerable concern in the areas of origin and even led to major precedent-setting lawsuits, they didn't create the kind of intense, state-wide controversy that Arizona is currently experiencing. These purchases differed from those that have recently occurred in several important

35 The discussion in this chapter is adapted from Chapter 3 of Woodard, Checchio, Thacker, and Colby, "The Water Transfer Process in Arizona: Analysis of Impacts and Legislative Options," 1988.

respects: the land was relatively nearby; the water was in the same hydrologic basin, although in different sub-basins; the land was in the same county, so that property tax impacts were internalized; and the cities incorporated the purchased land into their service area, assuring an adequate water supply for the rural areas.

These water transfers were limited in scope and driven by a relatively immediate need for water. In most respects, they bear little resemblance to the transactions characterizing Arizona's developing water farm market.

Compared to other western states, water transfer activity in Arizona, until recently, was relatively limited. Woodard et al. (1988) looked to Arizona's reliance on groundwater rather than surface flows for an explanation. They point to the fact that groundwater basins are basically drought-resistant and that declining water levels do not in themselves create a sense of urgency. Furthermore, while most surface flows can be transported by gravity, groundwater in Arizona is generally pumped at low altitudes and must be transported sometimes hundreds of miles.

Only recently did several forces, discussed in Chapter 2, come together to dramatically accelerate water farm purchases in the state. These forces include:

1. The 1980 Groundwater Management Act, with its Safe Yield and Assured Water Supply provisions;

2. Continued rapid growth of the state's metropolitan areas and the resulting increases in water demand;
Construction of the CAP aqueduct system across the middle of the state and passing through the two major metropolitan areas; and

A declining agricultural economy that made many farmers willing, if not eager, to sell their land.

**Water Farm Buyers**

Municipalities, private developers, investors, and utilities are all purchasing water farms in Arizona. Most of these farms, for reasons noted earlier, are located along the CAP route, and many lie outside of the AMAs.

**Municipalities**

City planners realize that without augmented water supplies, the Groundwater Management Act will place increasingly strict limitations on development in central Arizona. Arizona's large municipalities, however, are not currently facing these limits. When urban water providers shop for water farms they rarely look for "wet water" to meet existing needs; more often they seek additional water supplies to provide for the anticipated future demands of growing municipalities.

As CAP water becomes a more significant component of municipal water supplies within AMAs, municipalities become increasingly vulnerable to the variability of surface flows. In the future, water providers may buy water farms to enhance dry year supplies. Supplementary imported groundwater could relieve the
stress on the cities' own aquifers, while protecting their citizens from shortage when Colorado River or other surface flows are low.

Private Developers

Private developers are buying water farms in rural areas to guarantee a water supply for their development projects within AMAs. Eventually, developers may transport the water for use within an AMA, or may instead seek to trade water farm acreage to a municipal government in exchange for guaranteed water service to property that could be developed within the AMA.

Investors and Speculators

A perception prevails in the West that the value of water will rise as depletion of finite supplies leads to increased scarcity. While this is not necessarily the case, the perception is strong, and private investment companies have begun to show an interest in western water rights strictly for investment purposes. A Colorado investment company, for example, has compiled a portfolio of Colorado water rights on behalf of East Coast investors with a $35 million water rights management

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37 For evidence to the contrary based on analysis of actual trends in market water prices see Saliba and Bush, 1987, at 171-76.
fund. Other investment companies have looked to Arizona for similar investment opportunities.

Utilities

Water-intensive industries, particularly in the mining and energy development sectors, require reliable water supplies at reasonable cost. Power utilities, therefore, commonly buy land with access to abundant low-cost water supplies as sites for power-related industries.

Water Farm Sellers

Farmers and private developers are the most frequent sellers of water farms in Arizona. However, owners of relatively small parcels of desert land and even a major utility have sold land as water farms. In spite of the recent interest in acquiring water farms, willing sellers still outnumber those looking to buy.

Farmers

Farmers have been the most frequent sellers of water farms in the state. The agricultural economy in Arizona has been depressed for some time, and costs of irrigation water are high due to falling water tables and fluctuating energy prices.

The combination of these factors has left many farmers in a precarious financial position, making many eager to sell their farmland. Because most water farm purchasers are interested in buying land with established pumping histories, they look towards farmers for a source of irrigated acreage.

Private Developers

Private developers are also selling land for its associated water in Arizona. Some sell their water farms outright, while others have shown an interest in trading land with water rights to municipal governments in exchange for prime development acreage in central Arizona. Acquiring new water supplies through land swaps is an attractive option for municipal water providers who wish to avoid the financial and political costs of buying out farmers directly.

Management and Use of Water Farms

Because most water farms are bought to acquire water for which there is no present demand, water farm owners must decide on management strategies for the land in the interim between purchase and time of water withdrawal. Land-use decisions take into account various and often conflicting management goals, such as maintaining or enhancing the quantity and quality of the associated water, defraying ownership costs, and minimizing the adverse effects on the areas of origin. Additionally, management strategies vary depending on whether surface or groundwater is associated with the farm. The following descriptions provide an
example of the various management strategies currently being pursued by owners of water farms in Arizona.

McMullen Valley

In December 1986, the City of Phoenix purchased approximately 14,000 acres of land in the McMullen Valley from 24 private landowners for about $30 million. It is projected that existing groundwater resources acquired in the valley will supply the City of Phoenix with good to excellent quality water for more than 100 years. An annual exportable yield of 30,000 acre-feet of groundwater was projected based on current groundwater storage and historical pumping rates.

Phoenix does not expect to begin water production and delivery from its McMullen Valley land until 2000, at which time it hopes to use the CAP aqueduct to transport the water to the city. Phoenix is presently assessing land-use options for the McMullen Valley lands. The city hopes to reduce water use on the lands, defray ownership costs, and at the same time preserve as much of the regional economy and lifestyle of the residents as possible.39

Although the amount of cultivated acreage has declined since the Phoenix purchase, a substantial portion of the McMullen Valley land is still under production. For the first two years, the city was party to a 2-year agricultural lease with the nearby Colorado River Indian Tribes. The Tribes hired a local farm manager, who in turn hired local farmers to grow cotton on the land. More recently, Phoenix

39 Personal communication with Bill Chase, City of Phoenix, September 17, 1987.
entered into a similar lease agreement with a local businessman who maintains cotton production on the land, also using local labor. In the future, cattle grazing and other low-water use activities will be encouraged in place of more water-intensive uses of land.

Avra Valley

In 1971, the City of Tucson began a program of buying land in Avra Valley for its water rights. The city currently owns 22,735 acres, all within the Tucson AMA. This amounts to almost half of the privately owned agricultural and in the Avra Valley, and Tucson has considered acquiring the rest within the next few years. Water rights associated with the Avra Valley lands amount to approximately 60,500 acre-feet.

All of Tucson's Avra Valley land has been retired from agriculture and now sits idle. In addition to providing new water for use in Tucson, the city acquired land in the valley to exclude new development which might degrade the water quality or compete for the water supplies in the valley. Tucson has been withdrawing 14,000 acre-feet per year and transporting it to the city to satisfy existing urban water demands, principally in summer months of peak demand. This represents about one-quarter of the total entitlement.

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Because the Avra Valley is located within the Tucson AMA, it is unclear what portion of its water rights will count towards Tucson's assured water supply after 2025, the year by which the Tucson AMA must reach safe yield. The city may continue to buy land in the Avra Valley simply to preserve water for long-term future use and to protect its existing rights. However, Tucson may opt instead to buy land outside the AMA to secure water rights which will definitely count towards an assured water supply, or perhaps pursue both options. The decision will rest to some degree on local legislative action.

Pinal County Farms

In 1986, the City of Mesa purchased 13 individual parcels of irrigated farmland, totaling almost 11,000 acres. In total, the acquisitions cost nearly $30 million. All of the parcels are located within the Pinal AMA south of Coolidge and lie within either the Hohokam or the Central Arizona Irrigation Districts. The appurtenant rights total 29,352 acre-feet, based on the conversion of grandfathered irrigation groundwater rights to Type I non-irrigation groundwater rights.\(^{41}\) A portion of the land continues to be farmed under lease arrangements between Mesa and many of the original landowners. In response to a water price incentive in the

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\(^{41}\) Refer to Chapter 4 for an explanation of the conversion process.
lease agreement, the farmers have reduced their groundwater use by 80% by concentrating cultivation on one-fifth of the land previously farmed.\textsuperscript{42}

In 2001, when the city's CAP allocation will no longer guarantee an assured water supply, Mesa plans to permanently retire the land from irrigation and export its full entitlement of 2.7 acre-feet per acre. The portion not needed for municipal use at that time will be used to recharge the city's aquifer.

Planet Ranch

The City of Scottsdale purchased the 8,400-acre Planet Ranch along the Bill Williams River from the Arizona Ranch and Metals Company in 1984. Approximately 13,500 acre-feet of surface water rights in the Bill Williams River are associated with the ranch. Scottsdale purchased the ranch for $11.6 million and later invested an additional $3 million for improvements to the property. In an effort to perfect and maintain their water rights, Scottsdale is growing alfalfa, a high water-use crop, on 2,200 acres. Under Arizona law, surface water rights must be put to beneficial use in order to avoid forfeiture. Agricultural uses will be phased out as the water is needed for use in Scottsdale, although the city is not yet certain when this will be.

\textsuperscript{42} Personal communications with Karl Kohloff and Tom Merch, City of Mesa, during 1987.
Crowder-Weiser Ranch

In 1985, American Continental Corporation, a private land development company, purchased almost 4,000 acres of deeded land and 6,250 acres of state leased land near Vicksburg in La Paz County. Additional purchases by American Continental totaling another 3,765 deeded acres were made through 1986.

Estimates of the quantity of exportable groundwater from the property vary between 51,000 and 60,000 acre-feet per year. American Continental Corporation now manages over 13,936 acres of land in La Paz County. About 2,500 acres are currently under cultivation. American Continental has no immediate plans for retiring the acreage from production and may seek a buyer for the farm.

Lincoln Ranch

The 1,000-acre Lincoln Ranch is located along the Bill Williams River in La Paz and Mohave counties, upstream from the Planet Ranch. The associated water rights include 7,500 acre-feet of surface water rights in the Bill Williams River, plus an unspecified quantity of groundwater rights. The ranch was purchased in 1984 by Vector Interests (which later became Lincoln Ranch Partners) for about $5 million.

The Lincoln Ranch Limited Partnership has leased its water ranch back to the original owner who continues to graze cattle and grow a variety of crops. The partnership hopes to trade the associated water rights to a municipal government in exchange for water service on property it would develop within an AMA or sell the
water farm outright. It is currently assessing various options for transporting the water from the ranch to the Phoenix metropolitan area.

Arizona Public Service Lands

In 1978, Arizona Public Service bought approximately 12,500 acres of land with extensive water rights near the town of Vicksburg in La Paz County to construct a coal-fired electrical generating plant. The lands were chosen on the basis of both water availability and lack of potential air quality impacts. Because additional power is not currently needed, no plans exist to build the power plant before the year 2000. In the meantime the property has been leased to a tenant farmer under a 7-year lease arrangement and a portion of the land is under cultivation. The farm is currently in escrow and may be sold before the lease expires.

Potential Players

All of the water associated with water farm purchases in Arizona has presumably been bought for use in the state. The possibility exists, however, that out-of-state entities will attempt to buy water rights in Arizona for use in other states. The United States Supreme Court in Sporhase established that water is an article of commerce, and that statutory bans on out-of-state exports are therefore unconstitutional.\(^{43}\) The status of waters governed by interstate compacts, such as Colorado River water, is less certain. It is unclear whether users with vested water rights in

one state may transfer their entitlement to users in other states. As long as the transferability of Colorado River water is uncertain, the potential exists to transfer Arizona groundwater to other Colorado River basin states by way of exchanges of Colorado River water, or to market Colorado River entitlements directly.44

The potential for transferring water in Arizona has only begun to be explored. Future innovative transfer strategies are likely to include some new players, including Indian tribes (as discussed in Chapter 2), special water districts, and even the Arizona Department of Water Resources.

Special Water Districts

Water delivered by irrigation districts represents perhaps one of the largest potential sources of agricultural water available to municipal water providers, as over 50% of Arizona's irrigated acreage is served by irrigation districts.45 Transferring this water out of a district and into municipal uses, however, may be precluded in many instances.

The rules and regulations governing special water districts vary, depending on whether the district is organized under federal or state law. Irrigation districts delivering federally supplied water are subject to Reclamation Law, and in many instances are further restricted by specific contractual provisions. Irrigation districts

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44 See more thorough discussion of Colorado River Water in Chapter 4.

which do not deliver federally supplied water are organized under state law. The situation is further complicated, however, in that many special water districts fall into both categories. The Salt River Project, one of the earliest Reclamation projects, for example, is both a corporation organized under federal law and an agricultural improvement district organized under Arizona state law.

Arizona law is ambiguous as to the authority of an irrigation district to enter into water transfer arrangements with entities outside district boundaries. The district board is empowered to lease or sell "personal property"; however, this is generally not construed to include water. Furthermore, the statutes make no specific mention of the transferability of water out of an irrigation district. Likewise, district members have no stated right to transfer their share of district-supplied water out of the district, or even to other landowners within the district.

While it has traditionally been the policy of the federal government to defer to state water law, the Reclamation Act and subsequent legislation dealing with federal water development in the West places certain restrictions on projects built by the Bureau of Reclamation.

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46 Ariz. Rev. Stat. § 45-1578, renumbered Sec. 48-2990. Subsection 4 does empower a district board to lease, sell and otherwise dispose of real estate and personal property, but fails to make express mention of water. Whether this can be construed to include water as well is debatable. The conclusion that it cannot is supported by the fact that subsections 1 and 2 expressly distinguish between water and personal property.
Arizona Department of Water Resources

Another type of potential water farm buyer is the Arizona Department of Water Resources (ADWR). Under the Arizona Groundwater Management Act, if an AMA is not making sufficient progress towards eliminating overdraft by 2006, ADWR can begin buying land with irrigation water rights or otherwise negotiate to remove water rights from the market. This can only be done in AMAs, but that includes Pinal County, an area of considerable water farming interest. Ironically, water farming in the Pinal AMA could lead the state to remove further land from agriculture or potential development. There is currently no provision in the GWMA for the state to make in-lieu-of-tax payments or to otherwise compensate the area of origin.

Land Swaps

A different but related type of land dealing in the state, "land swaps", has the potential to produce impacts very similar to those of water farming. The attempt by Phelps-Dodge to exchange cash and very large tracts of land in rural New Mexico and Arizona for the Indian School property in Phoenix received considerable media attention. Deals such as this are appealing in many respects. Large areas of environmentally valuable land with recreational potential enter the public domain, while a relatively small piece of urbanized federal land is developed to a higher valued use. However, these deals add greatly to the property tax base in urban areas
while eroding the property tax base in those rural areas containing the swapped lands.
CHAPTER 4
CURRENT LEGAL FRAMEWORK FOR WATER TRANSFERS IN ARIZONA

The transferability of water in Arizona depends on its legal classification. Water is divided into two broad categories under Arizona law: surface water and groundwater. Each is broken into subcategories that are subject to different restrictions regarding water rights transfers and water transport. Surface water is defined as the waters of all sources, flowing in streams, canyons, ravines or other natural channels, or in definite underground channels, with the exception of effluent, whether perennial or intermittent, flood, waste or surplus water, and of lakes, ponds and springs on the surface. Groundwater is defined as all water under the surface of the Earth except water flowing in underground streams with ascertainable beds and banks.
Groundwater Transfers

The withdrawal, use, and transportation of groundwater is regulated by the provisions of the 1980 Groundwater Management Act. The GWMA was motivated, in part, by a need to resolve uncertainties created by court-made rules limiting the transportability of groundwater. Provisions of the act removed some limitations on the transportation of groundwater to promote development. For example, the act eliminated injunctive relief as a remedy for a neighboring landowner damaged by water transport and specified a set of circumstances and conditions under which a rightholder who has suffered injury may sue to recover damages. This means that a damaged party cannot stop the transport, but can, under certain circumstances, be compensated for any losses suffered. An action to recover damages is usually allowed when groundwater is moved across a basin or sub-basin boundary, but injury is not presumed merely from the fact of transportation. The legal nature of groundwater varies depending on whether the water is withdrawn from outside or from within an AMA.


53 Ibid. at § 45-545(A).
Groundwater Outside an AMA

There are no quantified groundwater rights outside of an AMA. Instead, a landowner simply has the right to pump water underlying the land. The groundwater must be withdrawn for "reasonable and beneficial" use—a fairly loose standard—but aside from this standard, there are no limitations on the amount withdrawn or on the place of use. If water is transported across basin or sub-basin boundaries, however, the transporter is liable for any damages to neighboring rightholders shown to be caused by the transport.\(^{55}\)

Groundwater Within an AMA

A landowner within an AMA is not automatically granted the right to withdraw groundwater. Unless the well qualifies as an exempt well,\(^{56}\) groundwater users within AMAs must have one of the following rights or permits to withdraw groundwater: grandfathered rights, withdrawal permits, service area rights, or storage and recovery permits.\(^{57}\) The transferability of groundwater within an AMA depends

\(^{54}\) Ibid. at § 45-453(1).

\(^{55}\) Ibid. at § 45-544 (2). Phoenix's proposed import of water from its McMullen Valley holdings would be an example of this type of transport.

\(^{56}\) Ibid. at § 45-454. An exempt well has a maximum pump capacity of 35 gallons per minute and is used to withdraw groundwater only for non-irrigation purposes. Ibid. at § 45-454(E) states that only one exempt well is allowed to serve the same use at the same location.

\(^{57}\) Ibid. at § 45-461 through -482 (1987).
on the type of right to which the groundwater is associated. Groundwater transfers within AMAs generally involve only grandfathered rights.

**Irrigation Grandfathered Rights.** Irrigation grandfathered rights (IGR) are rights to pump groundwater to irrigate lands within AMAs and are based on historic patterns of use. These rights are quantified on the basis of a "water duty", the amount of water in acre-feet per acre that is reasonable to apply to irrigated land, as determined by the Director of ADWR for each AMA. As state water conservation requirements become more stringent, water duties will gradually be reduced.

An IGR may not be sold apart from the associated land; in other words, the right is appurtenant to the land. The groundwater withdrawn under this right may be used only to irrigate the land to which the right pertains. In order to apply an IGR to a non-irrigation use, it first must be converted to a Type 1 right.

**Type 1 Non-Irrigation Grandfathered Rights.** A Type 1 right allows the owner of land which was retired from agriculture in anticipation of a non-irrigation purpose to retain entitlement to use water. A new Type 1 right is created by retiring and converting an irrigation grandfathered right; once converted to a Type 1 right, the

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58 Ibid. at § 45-462.

59 Ibid. at § 45-465.


62 Ibid. at § 45-463.
land associated with the right may never be returned to irrigation. With few exceptions, the irrigated land being retired must be located outside the service area of a city, town, or private water company. ⁶³

The rules governing Type 1 rights are complex. The original owner of a Type 1 right may withdraw the groundwater from the associated retired farmland for use at any location, for any permissible non-irrigation purpose, subject to limitations if the land is within a service area, either on or off the associated land. The original owner may also withdraw the groundwater from a well that is not located on the retired farmland; however, in this case, the water can only be used on the retired farmland associated with the right. ⁶⁴

Like an irrigation grandfathered right, a Type 1 right may be sold only with the land to which it is appurtenant. ⁶⁵ Once sold, a Type 1 right is more restricted; the new owner can withdraw the water only from the land to which the right is appurtenant, although the water withdrawn still can be used, under certain circumstances, either on or off the associated land. ⁶⁶

The law regarding inter-basin transfer of water pumped pursuant to a Type 1 right was amended by the legislature shortly after Mesa's acquisition of some 11,600 acres of farmland within the Pinal AMA. No one purchasing Type 1 rights

⁶³ Ibid. at § 45-469(A).
⁶⁴ Ibid. at § 45-473 (1987).
⁶⁵ Ibid. at § 45-473(A).
⁶⁶ Ibid. at § 45-473(D).
may transport water pumped pursuant to those water rights out of that AMA if the
rights were acquired after April 18, 1986.\textsuperscript{67} However, water pumped pursuant to
IGRs acquired for the purpose of subsequently converting them to Type 1 rights
under the "development plan" provisions of the law\textsuperscript{68} may still be transported out
of the AMA. Transportation of groundwater withdrawn under a Type 1 right is not
subject to payment of damages even if the pumping adversely affects adjacent
groundwater users.\textsuperscript{69}

The quantity of groundwater that can be pumped annually pursuant to a Type
1 right is fixed at the time of conversion from an IGR and is equal to the lesser of
three acre-feet of groundwater or the irrigation water duty, multiplied by the water
duty acres of the farm unit and divided by the irrigation acres.\textsuperscript{70} In other words,
the right is limited to either three acre-feet per acre or an estimate of the average
water consumed before the land was retired, whichever is less.

Both Tucson and Mesa purchased water farms within AMAs to obtain the
associated water rights. Tucson has already converted a portion of its IGRs to Type 1 rights; Mesa will have to do the same before it can transport any water from its
Pinal County land. Tucson's transfers involve moving water between sub-basins

\textsuperscript{67} Ibid. at § 45-473.01.

\textsuperscript{68} Ibid. at § 45-469.

\textsuperscript{69} Ibid. at § 45-542(C).

\textsuperscript{70} Ibid. at § 45-469(F).
within the same AMA, while the Mesa proposal involves transfers from one AMA to another.

**Type 2 Non-Irrigation Grandfathered Rights.** A Type 2 right is based on historical pumping of groundwater for uses other than crop irrigation such as for livestock watering, golf course irrigation, mining, power generation, or industrial purposes. Unlike an irrigation or Type 1 right, a Type 2 right is not appurtenant to any land and may be sold or leased for some non-irrigation purpose within the same AMA. The point of withdrawal may be changed as long as it remains within the same AMA. The whole Type 2 right or a portion of the right may be leased; if sold, however, the right must be sold in its entirety. Transportation of water withdrawn under a Type 2 right across basin or sub-basin boundaries is, unlike Type 1 rights, subject to the payment of damages.

**Service Area Rights.** Service area rights permit cities, towns, private water companies, and irrigation districts to withdraw groundwater to serve their customers. The service area is the area actually being served water, plus additions

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71 Ibid. at § 45-464.

72 Ibid. at § 45-464(F).

73 The law was amended in 1987 to clarify the right to lease. Ibid.

74 Ibid. at § 45-474(C).

75 Ibid. at § 45-543(A)(1).

76 Ibid. at 45-492.
to that area which contain an operating distribution system.\(^{77}\) The GWMA prohibits the extension of a service area primarily to include a well field within its boundaries, and the service area of an irrigation district may not extend beyond the boundaries of the district.\(^{78}\)

The service area right is an unqualified right limited only by the ADWR management plans which contain specific water conservation requirements aimed at achieving the management goals established for the AMAs.\(^{79}\) Service area rights are transferable when, for example, a city purchases a private water company and pumps pursuant to the former water company's service area right. Groundwater withdrawn under a service area right may be transported to any point within the service area, although transport across basin or sub-basin boundaries is subject to the payment of damages.\(^{80}\)

To demonstrate an assured water supply, a developer must not only demonstrate the physical availability of water, but also the legal right to access that water. That legal right is almost always based on a service area right, but, in some cases, the service area right must be established by pumping pursuant to a Type 1 or Type 2 right for a period of time. If a Type 1 or Type 2 right is necessary, the

\(^{77}\) Ibid. at § 45-402.26. Service areas as defined by ADWR are not the same as service areas defined by the Arizona Corporation Commission for private municipal water providers.

\(^{78}\) Ibid. at § 45-493 (1988).

\(^{79}\) Ibid. at § 45-564 to -569 (1988).

\(^{80}\) Ibid. at § 45-543.
Director will not issue a certificate of assured water supply unless the developer has acquired the Type 1 or Type 2 right.\textsuperscript{81}

\textbf{Surface Water Transfers}

\textbf{Non-Colorado River Water}

Under Arizona law, surface water belongs to the public and is subject to private appropriation with the approval of the Director.\textsuperscript{82} Under Arizona's prior appropriation system, a permanent water right is granted to those who first appropriate surface waters.\textsuperscript{83} The "first in time, first in right" nature of this doctrine means that, in times of shortage, junior appropriators--those with later-dated rights--may not be satisfied, making the priority date a very important characteristic of the right. A surface water right is established and maintained by the diversion and application of water to a specific beneficial use.\textsuperscript{84} If appropriated surface water goes unused for five consecutive years, the right may be forfeited and become available to new appropriators.\textsuperscript{85} This "use it or lose it" doctrine is causing Scottsdale to grow alfalfa, a high water-use crop, in an effort to perfect and maintain its surface water rights at the Planet Ranch.

\begin{footnotesize}
\begin{enumerate}
\item ADWR legal department, written communication, 1987.
\item Ibid. at $45-151(A)$ (1988).
\item Ibid. at $45-152$.
\item Ibid. at $45-141(C)$.
\end{enumerate}
\end{footnotesize}
Change in Point of Diversion. In Arizona, as in most western states, the point of diversion of a water right may be changed, provided that the source of the water does not change and other users' rights are not adversely affected.\(^ {86}\)

Change in Place of Use. Surface water rights may be transferred to a new place of use only with the approval of the Director. Prior to approval, an application for severance and transfer is made, followed by a hearing at which any interested person may contest the application.\(^ {87}\) Any transport by Scottsdale of its surface water rights in the Bill Williams River, for example, will be subject to the Director's approval.

Change in Purpose of Use. Under Arizona law, any changes in purpose or type of use must also be approved by the Director.\(^ {88}\) Although the statutes are silent regarding criteria for deciding on applications for change of use, the case law clearly establishes that a lawful change of use may not have any adverse effect on other vested water rights.\(^ {89}\)

Special Water Districts. Transfers of water rights within water service organizations such as irrigation districts, agricultural improvement districts, or water users associations, are permitted only with the prior written consent of the or-

\(^ {86}\) Ibid. at § 45-172.

\(^ {87}\) Ibid. at § 45-172(7).


\(^ {89}\) Ibid. at § 45-172.
ganization. In the case of a transfer involving water from a watershed or drainage area which supplies water to lands within a water service organization, the transfer must be consented to by each organization within the drainage basin. This provision prohibits the ADWR from even accepting an application for severance and transfer of a water right unless the consent of downstream water service organizations is first obtained. Consequently, water districts can veto a water transfer within their watershed without having to prove they would be damaged. This provision was promoted by the Salt River Project at a time when there was minimal regulation of water rights in an effort to ensure that SRP rights were not impaired through water transfers.

Colorado River Water

Colorado River water is a large resource likely to become the focus of future water transfers. Some transfers of Colorado River water have occurred already, and others are being considered. The rules and regulations governing the Colorado River, known as the "Law of the River", have evolved from a combination of interstate compacts, federal and state statutes, a major court decision, international

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91 Ibid. at § 45-172(5).
agreements, and various administrative decisions. The legal status of Colorado River water is complicated, as it falls under many jurisdictions.\textsuperscript{93}

The water of the Colorado River is apportioned between the Upper and Lower Basins by interstate compact. The Colorado River Compact of 1922 allocated an average 7.5 million acre-feet per year to each basin for their "exclusive beneficial consumptive use".\textsuperscript{94} The Lower Basin is entitled to an additional one million acre-feet of beneficial consumptive use per year as long as there is unused surplus in the Upper Basin's share.

The Boulder Canyon Project Act of 1928 authorized that the Lower Basin states agree to apportion their share as follows:

(1) Nevada - 300,000 acre-feet annually;

(2) Arizona - 2.8 million acre-feet annually, plus one half of any excess or surplus waters unapportioned by the Compact, and exclusive beneficial consumptive use of the Gila River and its tributaries within Arizona; and

(3) California - 4.4 million acre-feet annually, plus one half of any surplus waters unapportioned by the Compact.\textsuperscript{95}


\textsuperscript{94} The United States approval of the Compact was contained in Section 13(a) of the Boulder Canyon Project Act of 1928. Arizona, last of the effected states to ratify the Compact, did not do so until 1944.

\textsuperscript{95} 45 Stat. 1057.
The Lower Basin states never agreed to this apportionment, despite negotiations. The U.S. Supreme Court, however, concluded in *Arizona v. California* that Congress had indeed made this apportionment by authorizing the Secretary to do so.\(^{96}\) Section 5 of the Act authorized such contracts and prohibits the use of stored water by anyone except by such contract with the Secretary. Prior to that, contracts were made under the Reclamation Act of 1902, with water delivered to lands in reclamation projects, pursuant to water right applications filed by individual landowners.

The priority of use of Colorado River water was determined in *Arizona v. California*, giving California's allocation of 4.4 MAF/yr priority over Arizona's portion.\(^{97}\) This means that, in times of low flow, California will receive its full entitlement before any water is delivered to the CAP. Furthermore, use of Colorado River water must be consistent with the provisions of the international treaty with Mexico. In addition to provisions of *Arizona v. California*, rights perfected prior to enactment of the Boulder Canyon Project Act have a higher priority than rights created pursuant to the act. Similarly, a large portion of Arizona's total entitlement of Colorado River water is delivered to agricultural users under contracts with the Secretary which predate the CAP. These abundant senior rights to Colorado River water are attractive to municipal providers seeking secure water supplies.

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\(^{97}\) Ibid.
Modifications of the contracts to allow for water transfers, although possible, have happened in only a few cases. The Ak-Chin Settlement Act described earlier is one such example. As discussed in Chapter 2, the Department of the Interior's new openness to water marketing as a management tool may result in increased transfers of Colorado River water.

Interested parties have raised the possibility of interstate transfers of Colorado River water. Wyoming legislators, for instance, are assessing laws to facilitate leasing a portion of Wyoming's Colorado River entitlement, currently not needed by that state, to down-basin users. The Wyoming Attorney General and others have cautioned legislators about the difficulties posed in marketing Colorado River water from upper basin states to lower basin users. Similar proposals in Colorado have met with strong opposition, primarily from California and Arizona, who are entitled to freely receive surplus water flowing from the upper basin under provisions of the Colorado River Compact.98

The topic remains controversial, as some believe the Colorado River Compact clearly precludes transfers between the Upper and Lower Basins, while others disagree. Similarly, whether interstate transfers within the lower basin are prohibited is a matter of dispute. Whether a person can sell her or his Colorado River entitlement at all, or whether it automatically becomes available to the next junior appropriator, is one of the many unresolved questions regarding the transfer of

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Colorado River water. Despite the complexities and controversies surrounding this issue, transfers of Colorado River water are possible and cannot be ruled out.

**Transfers of Effluent**

In recent years, treated sewage effluent has received increased attention in Arizona for its potential as a marketable resource, for conserving water through exchanges of potable for nonpotable supplies, for recharging groundwater aquifers, and in satisfying Indian water entitlements.\(^\text{99}\) New golf courses in the state's urban areas are required to use primarily effluent, and existing golf courses are being encouraged to switch from potable water to effluent. Regulations prohibiting the filling of decorative lakes and ponds with potable groundwater are also increasing the demand for effluent.

Until recently, the legal status of effluent ownership, use, and transfer in Arizona was unclear. At issue was whether effluent is subject to regulation under state laws governing surface water appropriation and/or groundwater management. The controversy led to lengthy litigation, eventually reaching the Arizona Supreme Court.\(^\text{100}\) In reaching decisions on these issues, the Supreme Court had to decide

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\(^{99}\) In Tucson, for example, some 10 percent of the city's 60,000 acre-feet per year of effluent is currently reused by golf courses and parks; that percentage is expected to rise to 25 percent by 1995, as new golf courses come on line and schoolyards are connected to the expanding distribution system. In addition, an agreement to provide effluent to the Tohono O'odham Nation was a key component of the SAWRSA water rights settlement.

whether effluent that began as surface or groundwater remained such, or became a
different type of water, or was in fact no longer water at all. The court also
considered whether flows of effluent were appropriable and, if so, what the legal
limits of that appropriation were.\textsuperscript{101}

The court concluded that effluent was indeed water, but that Arizona statutes
distinguished between surface water, groundwater, and effluent,\textsuperscript{102} making it a
distinct type of water. In doing so, the court removed the use of effluent from
regulation under the surface water code and the groundwater code. If the decision
remains the last word on the subject, then effluent may be one of the most market­
able water commodities in Arizona.\textsuperscript{103}

However, when the court ruled that effluent was water, it established that it
was subject to legislative and regulatory controls. The court pointedly and repeatedly
invited the Arizona legislature to fill this vacuum in state water law.

The transferability, transportability and other relevant characteristics of
various types of water resources in Arizona are summarized in Table 1. Anticipated
legislative action, however, would modify the transferability of some of these types
of water rights.

\textsuperscript{101} Arizona Public Service Company et al. v. John F. Long and A Tumbling T
Ranches v. City of Phoenix et al., before the Supreme Court of Arizona, En Banc, No.
CV-86-0634-T, filed April 17, 1989.


\textsuperscript{103} For a thorough discussion of these decisions, see Woodard and Checchio,
1989.
TABLE 1. TRANSFERABILITY OF ARIZONA WATER RIGHTS

<table>
<thead>
<tr>
<th>TYPE OF RIGHT</th>
<th>IS THE RIGHT TRANSFERABLE?</th>
<th>CAN THE WATER BE TRANSPORTED?</th>
<th>LIMITS TO RIGHT</th>
<th>OTHER IMPORTANT CHARACTERISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUNDWATER</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irrigation Grandfather Right (IGR)</td>
<td>Yes, but only with the appurtenant land.</td>
<td>No, the right is tied to specific acres.</td>
<td>Limited by the water duty for the AMA.</td>
<td>IGR must first be converted to a Type 1 right to be applied to a non-irrigation use.</td>
</tr>
<tr>
<td>Active Management Area (AMA)</td>
<td>Type 1</td>
<td>Yes, but only with the appurtenant land.</td>
<td>Yes, with no liability for damages. New owner can't move water out of AMA.</td>
<td>Limited to the lesser of historic consumptive use or 3 acre-feet per acre.</td>
</tr>
<tr>
<td>Service Area Right</td>
<td>Type 2</td>
<td>Yes, and may be sold apart from the land, but can't leave its AMA.</td>
<td>Yes, but subject to payment for damages.</td>
<td>Right is quantified and is indivisible, but may be leased.</td>
</tr>
<tr>
<td>Non-AMA</td>
<td>Non-Colorado River Right</td>
<td>Yes, via purchase of private water companies or the acquisition of city-owned service areas.</td>
<td>Yes, but only within service area. Subject to payment for damages only across sub-basins.</td>
<td>Limited by conservation requirements for the AMA.</td>
</tr>
<tr>
<td></td>
<td>Colorado River Right</td>
<td>Yes, the right to pump water underlying the land is transferable with the land.</td>
<td>Yes, but subject to payment for damages.</td>
<td>Water must be applied to &quot;reasonable and beneficial use.&quot;</td>
</tr>
<tr>
<td></td>
<td>EFFLUENT</td>
<td>Yes, with the land to which the right pertains.</td>
<td>Yes, provided no other rightsholders are damaged.</td>
<td>Water must be applied to &quot;reasonable and beneficial use&quot; on appurtenant land.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not clear. Non-use by holder may free up water for junior rightsholders.</td>
<td>Not clear for interstate transfers and particularly for interbasin transfers.</td>
<td>Water must be applied to &quot;reasonable and beneficial use.&quot; Limited by contract with Sec. of Interior.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes, and with no attachments to the land.</td>
<td>Yes, but if placed in a natural streambed, it reverts to surface water. No liabilities for damages, even outside an AMA.</td>
<td>Water must be applied to &quot;reasonable and beneficial use.&quot;</td>
</tr>
</tbody>
</table>
CHAPTER 5

WATER TRANSFER COSTS

The costs involved in completing a water transfer significantly affect the amount of transfer activity. A water transfer will only occur in situations where the economic value of the water is greater in the new use. The added value of the water in its new use must be large enough to compensate the seller for the value of the water right, to cover the additional costs of completing the transaction, and to transport the water to its new place of use.

Value of Water Farms

Prices reportedly paid for water farms in Arizona range from as little as $600 per acre for irrigated agricultural land to as much as $1,500 per acre for raw desert and $2,600 per acre for agricultural land. To a large degree, the price reflects the relative eagerness of buyer and seller to complete the transaction. For the buyer, this is expressed as willingness to pay; for the seller, it is willingness to accept payment.

A potential buyer's willingness to pay for additional water supply delivered to its intended point of use will be influenced by current needs, anticipated future needs, and speculation on future water prices. The seller's willingness to accept

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104 This chapter is adapted from Chapter 4 of Woodard, Checchio, Thacker, and Colby, "The Water Transfer Process in Arizona: Analysis of Impacts and Legislative Options," Division of Economic and Business Research, University of Arizona, Tucson, 1988.
payment usually reflects the profitability of the activity in which the land and water are currently being used, any other value of the land and its structures, and the amount of debt incurred. It may also reflect the seller's valuation of the lifestyle or community values supported by the current water use.

The buyer's willingness to pay and the seller's willingness to accept payment define the range over which a price can be negotiated. Price, however, is a function of other factors as well. The relative bargaining strength of the two parties will often determine final price.

Bargaining strength in negotiations to purchase water farms is influenced not only by access to information and experience in negotiating, but also by relative supply and demand and the parties' financial positions. If there are relatively few potential sellers and many potential buyers, a seller's market (or more formally, an oligopoly) exists. Conversely, if there are few potential buyers, a buyer's market (or oligopsony) exists, and the negotiated price is likely to be at the lower end of the price range.

Additional costs can reduce or even eliminate the feasible price range and substantially alter the reported price for water farms. Transactions costs, including costs associated with selecting a water farm, financing its purchase, and implementing mitigation measures, are one type of cost. The expense of transporting the water from the area of origin to its intended point of use is another. Furthermore, risk and uncertainty associated with limited knowledge about the land and its underlying aquifer, unclear title to the land or water rights, withdrawals by neighboring pumpers,
and the future acts of legislatures and courts also affect the price paid for water farms, the level of water farming activity, and its geographic location.

**Transactions Costs**

A variety of costs are associated with completing a water right transaction and in securing approval from state agencies. Buyers and sellers of water farms expend resources to locate each other, negotiate the terms of sale, arrange financing, secure approval from state agencies, and record the water transfer. These are termed "transactions costs", and include information costs; contracting costs; taxes, fees and retention costs; and mitigation and compensation costs. These costs can be political or psychological as well as monetary.

**Information Costs**

Good information is essential in locating a suitable water farm. Sometimes those interested in selling water farms are listed with a broker. Agricom Management, for example, chose to use a real estate broker when making purchases in La Paz County. They enlisted the services of a local broker who already had most of the potential water farm listings. The broker negotiated with attorneys and other representatives from Agricom on behalf of the sellers.\(^{105}\) Brokerage fees can be substantial and are usually calculated as a percentage of the sales price of the

\(^{105}\) Personal communication with Joyce French, August 8, 1988.
property. Reported commissions on water farms range from 1.5 or 2 percent up to 8 percent.

In other instances, potential sellers must be sought out by interested buyers. Sometimes this proves very easy, given the eagerness of many sellers. According to a Phoenix official, for example, when word hit the street that the city was looking to buy irrigated acreage for water rights, potential sellers "came out of the woodwork."\(^{106}\)

Once sellers are identified, the buyer must be certain that a potential water farm will provide sufficient water of adequate quality to meet her/his needs. Determination of this usually requires hydrologic and engineering analyses. Additionally, a legal analysis is needed to ensure the transferability of the water rights and the certainty of approval of the transfer by state agencies. Phoenix, for example, in an effort to evaluate over 30 possible water transfer schemes, kept an engineer on retainer.\(^{107}\) The city reportedly spent $165,000 on technical studies of land in the McMullen Valley before the water farms were finally purchased.\(^{108}\) Similarly, Mesa reportedly spent $180,000 on hydrologic and transport studies before making its purchase of land in Pinal County.\(^{109}\)

\(^{106}\) Personal communication with Bill Chase, City of Phoenix, September 17, 1987.

\(^{107}\) Ibid.


\(^{109}\) Ibid.
Contracting Costs

Contracting costs are the regular costs associated with legal transfer of real property. These include the costs for services of title companies, attorneys, and appraisers.

Finding an experienced water farm appraiser can often prove challenging. There are only a few firms in Arizona currently offering to appraise water farms. Because the appraisal is generally of irrigated agricultural or raw desert land that is being purchased for its supposedly far more valuable associated water rights, the appraiser is forced to consider numerous factors not normally relevant in appraising rural land, including future municipal demand for water in the proposed area of use, alternative supplies, and transport options and costs. If the purchase is to be financed by sale of bonds, the appraiser must convince east coast bond houses of the legitimacy of the appraisal methodology. Phoenix spent $80,000 on appraisals of water farms in La Paz County, and Mesa spent $40,000 for independent appraisals of property in Pinal County.

Finance Costs

Finance costs can be very significant transactions costs. Unfortunately, data on the financing of water farm purchases by developers and speculators are difficult to obtain; the financing arrangements and costs incurred by municipalities, however, are better known.
Municipalities generally finance the acquisition or construction of major infrastructure through tax-exempt municipal bonds and/or current revenues. This is true for municipally owned and operated water departments as well. New wells, treatment plants, and water main extensions are routinely financed with a combination of water department revenues and revenue bonds. For a variety of reasons, however, Arizona municipalities have eschewed these traditional forms of finance when purchasing large tracts of remote land for water farms. The need to negotiate secretly and arrange financing quickly has motivated most municipalities to find creative financing alternatives for acquisition of water farms. In addition, some purchasers wanted to wrap up deals before the Arizona state legislature passed laws aimed at regulating interbasin transport of water or wanted to avoid asking voters to approve the purchases.

Only the City of Tucson has financed the purchase of its 22,500 acres of water farms in nearby Avra Valley with water department revenues. This was made possible because, rather than buying the acreage in one transaction, the city spent $24.7 million to buy the land in 35 small parcels over the past 16 years. Other municipal purchases of water farms in Arizona have been one-time transactions involving thousands of acres of land selling for tens of millions of dollars, which could not be financed from general revenues or user fees.

Instead of relying on the obvious financing mechanism, sales of earmarked municipal bonds, a number of other funding sources have been used. Chief among these has been municipal development corporations. These non-profit corporations
have been established by many cities to finance the construction of everything from courthouses to landfills.

Mesa used a municipal development corporation originally formed to finance the construction of a downtown parking structure to facilitate their purchase of 11,600 acres of Pinal County farmland. Initially, $17 million of existing water bonds earmarked for other purposes were used to make the advance payment. Then, title was transferred to the non-profit corporation, which sold $37 million worth of tax-free bonds. These were used to repay the $17 million in earmarked bonds and pay the balance on the land purchase. The municipal development corporation then entered into a lease-purchase agreement with Mesa, the payments being equal to the debt service on the bonds. Mesa pledged revenue from a $300 per dwelling unit increase in its water development fee for new construction and part of its share of state sales tax revenue to make the lease payments.

Phoenix's financing of the acquisition of 14,000 acres of land in the McMullen Valley in eastern La Paz County took an equally circuitous route. Phoenix recently sold a piece of its service area that lay within Scottsdale City limits to Scottsdale for $30 million. That money was used to make the initial purchase. Subsequently, title was passed to Phoenix's municipal development corporation, which originally was established to fund the construction of the city's convention center and civic hall. The non-profit corporation then sold tax-free bonds to repay Phoenix, with whom
they entered into a lease-purchase agreement, with the city pledging its share of state excise taxes to cover the payments.¹¹⁰

Mesa and Phoenix used non-profit corporations for financing water farm purchases for several reasons. In addition to allowing them to negotiate secretly the terms of the purchase and rapidly line up the financing, the cities also avoided bumping into state spending limitations based on income and limits on bonding capacity based on total assessed property values. The need for voter approval of municipal bonds or a budget override was also circumvented.

Scottsdale's purchase of the 8,400-acre Planet Ranch for $11.6 million in La Paz County used a simpler but still atypical finance approach—the previous owner provided the financing, much as many home owners "take back the mortgage" when selling their house. Scottsdale came up with the $2.8 million downpayment out of its general revenues and is making payments out of the general fund.¹¹¹ This financing approach provided advantages similar to the Mesa and Phoenix arrangements.

Scottsdale's use of disbursements from its general fund to make the payments on its water farm was intended to be temporary, pending completion of a comprehensive water management plan and evaluation of alternative funding sources. The city decided in August to shift the burden of paying off the water farm onto new

¹¹⁰ This description is based on a personal communication with Phoenix attorney, Phil Haggerty, on September 17, 1987.

¹¹¹ This discussion is based on a personal communication with Floyd Marsh, City of Scottsdale, November 1987.
construction through newly instituted water resource development fees of $1,000 per new single-family home, $600 per multi-family dwelling unit, and $2,000 per acre-foot of projected annual demand for non-residential construction. The fees, which went into effect October 5, are expected to generate about $2 million per year. In addition to financing the acquisition of water farms, the fees are also to be used to finance a tertiary treatment plant for effluent reuse and Scottsdale's portion of the cost-sharing requirements of a federal reclamation project.

While similar in concept to the increased water development fee instituted by Mesa to help finance its water farm purchase, Scottsdale's water resource development fees have attracted the opposition of developers. The Central Arizona Home Builders Association filed suit in 1987 in Superior Court to have the fees overturned.\(^\text{112}\) The issue revolves around Arizona's 1980 Groundwater Management Act and the interpretation of its 100-year assured water supply provision. Phoenix, Tucson, and other municipalities that are considering similar fees, will be watching the lawsuit closely.

Other municipalities who are considering water farm purchases are considering additional financing options, including the formation of improvement districts and the issuance of taxable bonds through municipal development corporations. Each of these alternatives offers certain advantages over more traditional municipal bonding approaches. There are, however, uncertainties and

potential hazards as well. Changes in federal law made in 1986 governing the purchase and use of property acquired with tax-free bonds reduces the portion of the property that can be used for a profit-making venture from 25 percent to 10 percent. These changes create possible barriers for municipalities purchasing farms and then negotiating lease-backs to the farmers so that the land can remain in production until the water is transported. In general, it is unclear what effect different financing mechanisms will have on the ability of cities to pursue creative alternatives to direct purchase of water farms, such as options to buy, options to transport in drought years only, and lease-back arrangements.

Another concern is that the speed and secrecy with which water farm deals are being made using alternative financing has limited public debate over issues such as the need for the purchases, who should bear the financial burden of the purchases, and other important details including impacts on the areas of origin and method of transport. At a time when the pendulum of public opinion in many areas appears to be swinging back towards the slow-growth or even no-growth sentiments that were evident in the mid-1970s, the use of financing alternatives that reduce public input into the decision-making process increases the risks of both flawed decisions and voter backlash.

Taxes, Fees, and Retention Costs

The fees and taxes associated with the sale of a water farm are similar to those involved in the transfer of other real property. Fees for title searches and
recording deeds are examples. In addition, there are fees payable to the Arizona Department of Water Resources for recording the transfer of ownership of water rights if the property is within an AMA, as well as fees associated with an application for changes in points of diversion. These costs do not represent a significant component of the total transfer costs.

Additionally, there can be substantial costs associated with retaining water rights. If surface rights have been acquired by purchasing a financially distressed farm, the rights must be protected from forfeiture prior to transporting the water out of the area of use. Because Arizona municipalities are more interested in holding water rights for possible future use than in transferring wet water, the costs of continuing to put the water to beneficial use can continue for decades and become quite high, especially if the farm was losing considerable money prior to the sale. Scottsdale's Planet Ranch property is an example of this problem. (Refer to Management and Use of Water Farms in Chapter 3.)

In the case of groundwater, there is no risk of forfeiture, but the fear that an AMA may be established in the area of origin or the threat of an adjudication of a river system can cause the owners of water farms to build pumping histories by applying large quantities of water to the land to produce low-value or surplus crops. The owners of Crowder-Weiser Ranch reportedly are applying extravagant amounts of groundwater to the land to grow alfalfa.
Water Transfer Policies

State water transfer policies that affect these transactions costs will undoubtedly influence the number of water transfers and water farm purchases. When transactions costs, which include the costs of satisfying state laws, are high, a transfer will only occur if the value of the water in the new intended use is considerably higher than the value of water in its present use. If policies are too restrictive or costly, they will prevent some desirable transfers from occurring.

Perhaps the most difficult challenge for policy makers is to identify the interests to be protected and the balance desired between promoting water markets and protecting third parties affected by, but not directly involved in, the transfers. Once formulated, broader policy goals can be best realized by designing straightforward water transfer processes.

Transportation Costs

The cost of transporting water from a water farm to its intended place of use can vary significantly and, thus, often determines whether a transaction will occur. The costs required to move, lift, and store water tend to be large relative to the value of the resource. They are particularly significant if new infrastructure needs to be constructed or if considerable energy is required for lifting the water.

For these reasons, prime water farm acreage must not only provide well-defined rights to substantial groundwater or abundant surface flows of adequate quality for the projected use, but the water farm should also be situated to afford a
reliable and economical method of transporting the water from the area of origin to the intended place of use. Owners of water farms in Arizona have several potential water transport options available. Some of these include the Central Arizona Project aqueduct, other existing aqueduct systems, transport facilities built expressly for this purpose, natural waterways, and water exchanges.

CAP Aqueduct

The Central Arizona Project may create enormous opportunities for water development by providing a conveyance system which crosses some of Arizona's finest agricultural acreage before arriving in central Arizona. Most proposed strategies for transporting water from water farms rely upon the CAP aqueduct to convey non-CAP water from areas of origin to areas of use. Ironically, the CAP, which was originally conceived as a means to save agriculture in Arizona, may instead provide for the delivery of rural water to urban centers. Many unanswered questions remain, however, regarding the use of the system to deliver water not allocated through the project, or non-project water.

The CAP aqueduct system creates opportunities and imposes constraints on intra-state water transfer arrangements. The Granite Reef Aqueduct extends 190 miles from Lake Havasu to the Salt River. It has a capacity of 3,000 cubic feet per second (cfs), or just over 2.1 million acre-feet per year. The first 17 miles of the aqueduct contain an over-sized canal section which receives flow from the Havasu Pumping Plant and can act as an in-line storage reservoir, allowing more pumping
to occur at off-peak hours when energy costs are lower. Potential recharge basins such as Butler Valley located along this reach of the aqueduct also offer management options. The New Waddell Dam will increase system flexibility by providing seasonal storage in the winter, when demand for CAP water is at a minimum. The Salt-Gila Aqueduct extends about 58 miles south from the Salt River to a point five miles north of the Brady Pumping Plant and has a capacity of between 3,000 and 2,250 cfs. Finally, the Tucson Aqueduct runs 87 miles down to the northern border of the San Xavier District of the Tohono O'odham Reservation southwest of Tucson. Its capacity ranges from 2,250 cfs at the beginning to 200 cfs at its terminus.

The canal infrastructure makes many innovative and potentially beneficial transfer arrangements feasible in an engineering sense. However, important economic and policy-related questions remain to be addressed before Arizona can take advantage of these opportunities.

The Central Arizona Water Conservation District (CAWCD), a tri-county entity created by the Arizona legislature, is the agency responsible for contracting project water, repaying project costs, and operating and maintaining the system. The project, however, is owned by the federal government. Its use to convey non-project waters, therefore, must first be authorized by the Secretary of the Interior. Further, the federal government has preserved the right to excess canal capacity needed by the secretary to deliver both Indian and non-Indian water entitlements. In light of the Department of the Interior's recent policy statement, it is almost certain that the Secretary will authorize use of the CAP for facilitating intra-state transfers provided
that certain criteria are met (refer to discussion of the role of the federal government in Chapter 2).

Any remaining excess canal capacity must be determined and criteria devised for allocating the right to its access.

During the early years of the aqueduct's operation, there will be comparatively little free capacity within the system to permit such arrangements; the initial Arizona allocation of Colorado River water will be large enough to use almost all of the hydraulic capacity of the system. Official projections show a decline of a half million acre-feet or more in Colorado River water available to Arizona as the states of the Upper Basin (Colorado, New Mexico, Wyoming, and Utah) develop the storage capacity necessary to make full use of their compact entitlements. If borne out, such reductions would free up aqueduct capacity for use in transporting transferred water (Woodard et al., 1988).

These future projections, however, are based upon the assumption that the authorized but still unbuilt units of the Colorado River Storage Project will be completed. That prospect is now remote, at best. It is just as likely that there will be little net increase in Upper Basin Colorado River water use in the foreseeable future. If so, and barring a recurrence of a very dry cycle within the basin, Arizona could experience very little or no reduction in Colorado River deliveries through the CAP aqueduct. This would substantially restrict the availability of the aqueduct for conveying transferred water (Ibid.). In spite of the interest shown in using the canal to import water from water farms, CAWCD officials may not be willing to transport
non-project waters if surplus Colorado River water is available.\textsuperscript{113} Such a policy would provide an added incentive for urban water providers to contract for CAP allocations, rather than relying on imports from water farms.

Another concern in transporting non-project waters is that the quality of water delivered to CAP contractors will be affected by the quality of all waters introduced into the system. Because water from the Colorado River will average about 750 milligrams per liter (mg/l) total dissolved solids (TDS), water from farms of which groundwater has TDS concentrations in excess of 750 mg/l could degrade the quality of water in the system. Even if the water has relatively low TDS, elevated levels of fluoride, nitrates, organic farm chemicals, or heavy metals could cause problems. On the other hand, the introduction of water of a higher quality could benefit all canal users. The CAWCD has suggested that federal water quality standards for discharge into a natural stream would be applied to non-project water put into the CAP aqueduct.\textsuperscript{114}

The responsibility for paying project costs must also be determined for canal users delivering non-project waters. The operation and maintenance costs, as well as the capital repayment costs on the Bureau of Reclamation loans, must be shared. Also of concern to canal users are the pump costs associated with moving the water. The CAWCD plans to pump CAP allocations during the hours of off-peak power demand, using low-cost project power. This means that pumping additional water

\textsuperscript{113} Personal communication with Larry Dozier, CAWCD, 1987.

\textsuperscript{114} Ibid.
will be considerably more expensive, as it will most likely be pumped during peak power use hours with market rate energy. Additionally, an estimation of the distribution of excess capacity that will occur in the aqueduct over time, by season and reach, in drought and wet periods has yet to be made. Because CAP contracts allow up to 12 percent of annual deliveries to be scheduled in particular months, it is very likely that the aqueduct will be utilized fully during summer months of peak water demand (Woodard et al., 1988).

In spite of these uncertainties, every major water farm purchased thus far in the state, at an aggregate price of more than $100 million, is located near the CAP aqueduct, demonstrating its attractiveness as a potential means of moving water to central Arizona (see Figure 2). Mesa, Phoenix, Scottsdale, and private developers with water farms as well as other municipalities contemplating water farm purchases are all assuming that they will be able to use the aqueduct to move water. Appraisers of water farms are making the same assumption when putting a value on the land.

Issues involving excess capacity and the terms under which it will be made available to owners of water farms must be addressed before the CAP can enter into any formal arrangements for use of excess canal capacity. The CAWCD, however, does not expect to address these issues until about 1995 to allow sufficient operational experience to be gained before any final decisions are made.115

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115 Personal communication with Larry Dozier, 1987.
FIGURE 2. MAJOR WATER FARMS AND THE CAP CANAL
New Infrastructure

Other options have been considered to transport water should the CAP canal or other existing infrastructure be unavailable. The most obvious, a direct pipeline from the water farm to the intended place of use, tends to be unattractive due to high costs. Phoenix, for example, estimated that it would cost at least $200 million to build a direct pipeline along the CAP right-of-way from its La Paz County water farm to the city.\textsuperscript{116} One advantage of a dedicated pipeline is that it can feed directly into a municipal water system, obviating the need to treat water that has been mingled with Colorado River water.

Even if the CAP aqueduct can be used to transport water from the general vicinity of water farms to the intended place of use, infrastructure may be needed to move the water from the water farm to the aqueduct. If existing canals and pipelines are not available, they will have to be built. Phoenix, for example, estimates that it would cost up to $50 million to move water 80 or 90 miles from its water farm to the aqueduct.\textsuperscript{117} Environmental costs must also be considered.

Natural Water Courses

Natural waterways provide another possible means of transporting water. Use of natural waterways has two substantial advantages over the use of aqueducts, pipes,


\textsuperscript{117} Ibid.
and pumps. First, construction and maintenance costs are avoided. Second, no energy is required, because the water flows by gravity from the area of origin to the area of use.

Under current state water law, however, water put into a natural waterway, unless as part of a recharge project, is considered part of the stream and becomes available to senior appropriators along with all other waters in the watercourse. Legislation would be required to establish a right to reappropriate water put into a natural stream channel solely for conveyance purposes. Scottsdale's plan to use a combination of natural water courses and existing infrastructure has been thwarted by these legal restrictions. Originally, the city was going to let its surface water rights in the Bill Williams River flow into the Colorado just upstream of the CAP intake at Parker Dam, where it would be pumped into the aqueduct and be delivered to Scottsdale. Unfortunately, when the water enters the Colorado River, it is no longer Bill Williams River water, and it no longer belongs to Scottsdale.

Exchanges of Water

In many instances, water exchanges can facilitate water transfers by minimizing transportation costs. Mesa, for example, has proposed to exchange its Pinal County groundwater for an equivalent quantity of Tucson's CAP allocation. Mesa would take a portion of Tucson's CAP allocation out of the canal above Pinal County and replace it with groundwater pumped into the canal farther along its route, which would then flow to Tucson. This exchange would require very little
physical infrastructure and energy and would obviate the need to transport Mesa's groundwater from Pinal to Maricopa County.

Water exchanges could conceivably facilitate water transfers between Yuma and central Arizona or even southern California. One possible scenario might involve an exchange of groundwater from a municipally owned water farm in Yuma County for part of Yuma’s Colorado River allotment. The transfer could be accomplished by supplying local farmers, who currently utilize Colorado River water delivered through the Yuma-Mesa project, with groundwater in exchange for their allotment of Colorado River water withdrawn at Lake Havasu, to be transported to central Arizona via the CAP canal. Although institutional impediments may make such exchanges unlikely, possibilities do exist for such arrangements. These and other innovative strategies undoubtedly will be devised to transfer rural water to areas of growing urban water demand.

Groundwater Recharge

Groundwater recharge, as a means of water storage, will be an important component of water transfers and exchanges by allowing excess water available during wet years to be stored for use during dry years. In 1986, the Arizona legislature passed a bill which allows water users to recover water stored underground.\(^{118}\) When stored water is recovered, it may be used in any way that was permissible prior to its being recharged. By clarifying rights to recharged water, this

legislation enhances the opportunities for creative transfer and exchange arrangements and encourages conjunctive management of water resources.

Phoenix, for example, plans to conjunctively manage surface and groundwater with long-term water banking through recharge. The city plans to recharge excess CAP water available during wet years and to transport groundwater from its McMullen Valley water farm into the Phoenix AMA for recharge during dry years. This plan allows for operational flexibility after the year 2025, when groundwater withdrawals within the Phoenix AMA must be in balance with recharge.\textsuperscript{119} The feasibility of this plan depends on the availability of space in the CAP canal during dry years to transport the McMullen Valley water.

\textsuperscript{119} Personal communication with Bill Chase, City of Phoenix, September 17, 1987.
CHAPTER 6
THIRD PARTY EFFECTS OF WATER TRANSFERS

Potential Benefits

Water transfers can potentially benefit a wide range of interests, primarily by providing flexibility in water use. Temporary transfers of agricultural water, for example, allow for quick responses to drought conditions, while long term transfers—from lower to higher value crops or from agricultural to municipal and industrial use—allow for flexibility in responding to changing economic conditions.

In addition, water reallocation can provide substantial environmental benefits by offering an attractive alternative to construction of large dams and complex delivery systems. Furthermore, transfers of diversion rights to instream flows can reflect westerners' growing appreciation of the value of free-flowing waters.

In general, water markets allow water to move between various sectors of the economy in response to changing conditions. At the same time, markets allow the original owner of the right to be compensated when the water moves to higher economic valued uses.

In the case of Arizona's water farm purchases, buyers and sellers directly involved in water transfers, as well as various third parties, may benefit from water farming. Benefits to importing municipalities are perceived to be substantial, as an infusion of water into a community is thought to ensure future growth potential (Ingram, Martin, and Laney, 1982). On the seller's side, farmers whose operating costs exceed their returns can benefit from the opportunity to sell their farms for a
profit. Private developers and speculators also stand to realize considerable gains by selling water farm acreage.

**Potential Adverse Effects**

While their benefits are widely recognized, water transfers also raise concerns about damage to other water right holders, adverse effects on areas from which the water is taken (areas of origin), impaired water quality, and reductions of instream flows needed for fish, wildlife, and recreation.

Many in Arizona fear that urban interests will benefit from water transfers only at great costs to rural areas, leading to inequities within the state. Because the public agencies in the area of origin are seldom party to water farm transaction decisions, their interests are frequently not taken into account. There is increased concern to assure protection of third-party interests when rural land is purchased for its water (Transcripts, 1987).

Some of the effects on water-exporting communities occur immediately, while others evolve over time. The effects correspond to three distinct phases of the water farming process--the change of ownership of the water entitlement; the actual retirement of irrigated agriculture on the water farm; and finally, the physical withdrawal and transport of the water out of the area of origin. These impacts fall into four general categories: fiscal, economic, environmental, and development potential.
Fiscal Effects

Direct fiscal effects occur immediately upon purchase of the land by a municipality or other tax-exempt entity. Fiscal effects result primarily from constitutional exemptions of municipally owned land from taxation. Property tax is the major revenue source for local governments; unless mitigated, removal of land from the tax base places a heavier burden on the remaining taxpayers if the level of county services is to be maintained. At the same time, the county’s bonding capacity and legal debt limit, which are based on the county’s net valuation, are decreased. Net valuation is also the basis for the distribution of state-shared revenues, particularly the state-shared sales tax. This means that a county receives a progressively smaller portion of state sales tax revenue as municipally owned acreage increases.

Counties with a small percentage of privately owned land are particularly vulnerable to the fiscal effects of large municipal landholdings. La Paz County is a prime example. More than 80 percent of the land in La Paz is federally owned, with Indian reservations comprising another 8 percent, and the state owning an additional 7 percent. This leaves less than 5 percent of county land in private ownership.

Furthermore, local revenues, both direct and through state-local revenue sharing, will be affected as less money circulating through the county reduces taxable transactions. Overall population is also affected as reduced job opportunities force migration from the rural area. If a high enough percentage of the basic industry jobs is lost, the economic viability of the community is threatened.
Economic Effects

Most of the potential economic losses attributed to water farms will occur during the second phase of the water-farming process, when irrigated acreage is retired. Farm sector jobs and income will decline when farmland goes out of production. These declines in turn affect businesses which depend on and supply agricultural customers. Examples of related businesses include cotton gins, seed suppliers, tractor mechanics, and even accountants and lawyers retained by farm-related businesses. Agricultural and related sales may decline all at once or gradually, depending on whether agriculture is retired suddenly or phased out over time. In either case, there can be both direct and indirect effects.

These declines in local agricultural incomes will give rise to additional induced income effects. Money earned by employees in the agricultural and farm service and supply sectors is recirculated throughout the community. A decline in incomes from agriculture, therefore, adversely affects seemingly unrelated businesses, such as the local coffee shop, gas station, or general store. Lowered wages and/or employment in these establishments further affects still other businesses. Through this mechanism, referred to as the multiplier, effects on the agricultural sector ripple (or multiply) throughout the local economy.

The multiplier means that every dollar gained (or lost) in local incomes is worth more than a dollar to overall county incomes. The size of the multiplier depends on what share of county incomes is spent inside the county. In rural counties, particularly those that are close to cities, consumers spend more of their
dollars away from home. Moreover, with increasingly modern agricultural practices, farm operators more frequently make their purchases out of county and often out of state. Therefore, multipliers in rural areas tend to be smaller than in urban areas.

The incomes to farmers from the sale of their land can counterbalance or even outweigh these effects if they are reinvested or spent in the local economy. This will only be the case, however, if there is a nonagricultural growth sector in the region and if adequate water supplies remain to guarantee the future of that sector.

In addition, it has been argued that the farms purchased for their water are marginally profitable and that many would be economically abandoned anyway. However, agriculture has historically gone through cycles of prosperity and poverty, and conditions may well improve. In addition, there is growing evidence that it is not necessarily the marginal agricultural acreage that is being purchased. Potential water farm buyers are willing to pay for access to the largest, highest quality aquifers in the most convenient locations, regardless of the crop being grown or its profitability. Pecan orchards have been purchased and alfalfa fields ignored because of these factors.

Development Potential

Future economic development in the area of origin is threatened both when the purchase of a water farm is made and when the water actually leaves the area. Although it is difficult to predict the future economic development of an area, it is clear that the purchase of large tracts of land and the permanent removal of water
from a region may limit development. The land available for development can be significantly reduced if considerable water farming occurs in an area and locks up the land or increases its price. In some parts of the state, highways, rail lines, and aqueducts run along parallel routes; land purchased for its proximity to possible water transport infrastructure (such as the CAP) may be the most desirable land for commercial or industrial development as well.

Individual water-farm purchases are unlikely to lock up enough land or water to make development in the area of origin infeasible. However, transactions costs and risk and uncertainties associated with making water-farm purchases are relatively high, which tends to make the typical water-farm purchase large; in addition, the importance of minimizing transport costs has led to clustering of water-farm purchases. Fiscal, economic, and environmental effects compound any constraint on development by making the community generally less appealing. Any change in the local economy, whether direct or indirect, affects the fiscal condition of the rural area. In turn, the fiscal features of the community have their own separate but important impact on economic development. A community's ability to attract jobs, for example, depends on both its tax rate and on its spending patterns. The quality of public services, particularly the quality of public schools, is an important consideration in the location decision of persons and businesses.

Furthermore, decline in basic employment stimulates migration out of the region. Deterioration of the quality of public services, employment, and population, taken with the presence of unreclaimed retired farmland, can give the impression
that a community is on the decline, thereby frustrating attempts to attract non-agri-
cultural development.

More importantly, the perception that an area's water and land are being
locked up to benefit distant areas, whether accurate or not, can be as damaging to
the area of origin as any actual shortage. If an area of origin has no control over its
water supply and is seen as being "sucked dry", future development will be impeded.

Additionally, when a significant amount of local real property is owned by
outside municipalities and developers and is earmarked for uses that do not
contribute to the local economy, the future of that region depends, to an undesirable
degree, on decisions made elsewhere by persons with no vested interest in the local
welfare. When such a situation is unexpected and occurs over a relatively short
period of time, strong feelings of fear, anger, and frustration are almost inevitable
(Nunn and Ingram, 1988).

Environmental Effects

Environmental effects may be felt in either the second or third phases of the
water transfer process. When water is actually moved, transfers that involve surface
flows may result in degradation of water quality, decreased stream flows needed by
fish, and loss of riparian habitat. Where surface water and groundwater are closely
linked, the export of groundwater can also alter surface flows; increases in
groundwater pumping for export will affect local vegetation where water tables are
high.
In contrast, a transfer of relatively deep groundwater does not directly affect the surface water or land. Instead, most of the environmental effects are associated with the second phase of the transfer process, the retirement of irrigated agriculture. When land goes out of cultivation, a natural revegetation process called "secondary succession" begins.\(^{120}\)

Secondary succession is the natural process of revegetation and involves the establishment of a succession of plant species. Russian thistle (tumbleweed) is the first species, readily dispersing its seeds and quickly dominating the land. Succession continues until the plant community has stabilized with the environment, taking possibly 20 to 40 years to establish native creosote and salt bush (Karpiscak, 1980).

This natural process varies with the climate and soil type, and is very slow on fine-textured soil and in low-rainfall areas (Robinette, 1986). This has been the case for abandoned farmlands near Eloy, where little revegetation has occurred in the 20 years since farming ceased. Instead, the soil has crusted over in large barren areas where no vegetation can get established, and plants grow only in low areas where rainwater collects.

During the revegetation period, the area experiences a variety of nuisances, including tumbleweeds and blowing dust, as well as adverse effects on wildlife (Supplee, 1988). Lack of vegetative cover also leaves the land vulnerable to serious soil erosion from floods. Some rural residents have noted that the value of farmland

\(^{120}\) For an excellent description of the revegetation process, see Gary Thacker, "Retired Farmland," in an unpublished paper available through the Pima County Agricultural Extension Office, Tucson, Arizona.
decreases when adjacent land succumbs to disuse. In the past, rural residents have been successful in suits against water farm owners over these effects.

The environmental effects of land retirement can be mitigated by land-management practices. Establishment of a permanent vegetative cover before the land is retired from agriculture greatly reduces blowing dust and tumbleweeds and shortens the time required to reestablish native plant species.

Other Potential Effects

Other effects of water farming, even harder to quantify but no less genuine, include effects of water transfers on community cohesion, local traditions and cultural values, and the political viability of local governments and irrigation districts in the area of origin. One pervasive effect of water farming on areas of origin has been termed a loss of local self-determination, as the future of an area moves beyond the control of its residents. It is this sense of uncertainty, frustration, and vulnerability, as much as the current, tangible harm, that is fueling the ardent demands for regulation of water transfers from rural counties.

When assigned a dollar value, the losses suffered by areas of origin may appear insignificant when compared to the total state economy or even when compared to the substantial benefits of additional water supply which may accrue to

the new water users. Such losses, however, tend to be concentrated in particular areas and can seriously impair the viability of small, rural communities which may lack the economic strength and diversity to respond to such rapid changes.

Perhaps the most difficult policy challenge is to identify which effects of water farming should be mitigated or compensated. Policy makers must find the desired balance between encouraging water transfers and protecting vulnerable third parties. Overall policy goals, once established, must be carefully reflected in specific water transfer policies. To be effective, policies should promote beneficial water transfers while protecting important interests and public values. Because many effects of water farming are felt even if no water is actually transported out of the area of origin, the timing of the effects must be considered when formulating transfer policies.

**Legislative Efforts in Arizona**

Existing state water law developed prior to the increased water farming activity of the mid-1980s has proved inadequate to protect areas of origin from the adverse effects of water transfers. Earlier statutes were aimed at protecting only water right holders and water service organizations from injury due to water transfers. Currently in Arizona, the only third-party impacts that must be

122 Ariz. Rev. Stat. Ann. §45-172(5) (1987) states: "No right to the use of water on or from any watershed or drainage area which supplies or contributes water for the irrigation of lands within an irrigation district, agricultural improvement district or water users association shall be severed or transferred without consent of the governing body of such..." However, there are no reported Arizona cases involving
mitigated or compensated are those impairing neighboring pumpers or downstream diverters; however, there are several instances of buyers negotiating with third parties over other types of impacts. Mesa, for example, voluntarily negotiated to compensate Pinal County over $100,000 in lieu of taxes in 1986. This is because, despite the lack of statutory or regulatory mandates to compensate or mitigate, buyers are aware that intense political reactions to transfers in areas of origin may be costly in terms of legislative response and political fallout in the area of use. Despite the legislature's failure to pass comprehensive water transfer legislation, several measures have been enacted which respond to specific concerns.

Transfers Study

During the 1986 legislative session, following calls by angry rural interests for a moratorium on all water-farm purchases, Arizona lawmakers enacted legislation which established the Joint Legislative Committee on Groundwater and Surface Water Exportation and appropriated $200,000 for a hydrologic and socio-economic impact study of water transfers. The study was intended to guide legislators in evaluating the need for additional legislation governing water transfers in Arizona.

This law.

Statutes also require a hearing with ADWR before transfers of appropriated surface water rights can be approved. Such hearings are publicized in local papers and any interested person may speak about the impacts of the proposed transfer.


It was hoped that the study would also prove to be a useful planning tool for rural communities with water farm potential.

The study provided baseline conditions and addressed the hydrologic and socio-economic effects of potential water transfers. The study was to have suggested ways to mitigate adverse impacts of water transfers as well as recommend legislation for the 1988 session. It is generally recognized, however, that the scope of the study was too narrowly defined and executed to provide useful policy guidance to the legislature. The Joint Legislative Committee on Groundwater and Surface Water Exportation disbanded without making formal recommendations.

In-lieu Tax Payments

Another bill enacted in 1986[^124] provides the authority for municipalities which own water farms to make voluntary contributions, in lieu of taxes, to the county and other taxing authorities in which the city's rural property is located.[^125] It stipulates the time frame and methods for determining the amount of the contribution. The legislation also provided for control of noxious weeds and tumbleweeds on the water farms.


[^125]: This addresses the concern that tax payers residing in a city owning a water farm could sue to stop any voluntary tax payments to the area of origin because of the constitutional prohibition on taxing municipal property.
While the legislation addressed an immediate concern, the statute is not considered a long-term solution to the tax-base problem. Rural counties want in-lieu tax payments to be mandatory, to provide some assurance that payments will be made now and in the future. Such assurances are needed for areas of origin to sell tax-free bonds backed by in-lieu tax payments. While such a measure may require an amendment to the Constitution, the legislature has sought other ways to assure payment of in-lieu taxes. In addition, rural counties want water farms to be assessed at a rate other than the agricultural rate used prior to purchase by municipalities. Arizona's agricultural land is taxed on the basis of its production value, rather than on its market value, and market-value tax assessments are generally considerably higher.

Property Tax Base

A 1987 bill\(^\text{126}\) further addressed the problems of eroding tax bases in areas of origin created by the constitutional exemption of municipally held lands from county tax rolls. The new law allows for municipally held lands to be included in a county's net assessed valuation for the purpose of distributing state-shared sales taxes to counties. This legislation also permits municipal holdings to be counted in assessed valuation for determining county levy limits, but only if the municipality agrees, through an intergovernmental agreement, to pay in-lieu taxes to the county.

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The constitutionality of this provision as it relates to bonding capacity is in doubt.\textsuperscript{127}

Retired Farmland

In Arizona, years of conflict and litigation over dust storms and tumbleweeds generated by municipally owned water farms culminated in legislation requiring owners of water farms to maintain the retired agricultural acreage free of dust and noxious weeds.

In most instances, revegetation of retired farmland can be fairly straightforward, particularly when a cover crop is planted as the farmer's last crop. Within Arizona's AMAs, however, revegetating retired farmland can be complicated. Under the GWMA, once Irrigation Grandfathered Rights are converted to Type 1 rights, the associated water can no longer be applied to the land, even to revegetate abandoned farmland.

This provision has hindered Tucson's efforts to control the tumbleweeds on its Avra Valley water farm. Instead of irrigating a cover crop to hasten the reestablishment of native vegetation, city funds are spent to simply disc the soil, a process which must be repeated each year.

\textsuperscript{127} The legislature attempted to deal with the problem of municipal immunity from local property taxes without amending the constitution by encouraging municipalities to enter into binding intergovernmental agreements to make in-lieu of tax payments. That they may not have succeeded in this is suggested by the several bills introduced in the last legislative session that attempted to modify the current provision.
Unresolved Policy Issues

The need for additional water transfers legislation is widely accepted in Arizona. During the last three legislative sessions, over 20 bills have been introduced on the subject. Most of these bills dealt with specific aspects of water farming. However, attempts to negotiate and legislate a comprehensive water transfers package have been unsuccessful to date, leaving several key issues unsettled.

While eventual passage of comprehensive legislation is widely assumed, this does not guarantee that all important issues will be settled. The comprehensive bill that passed the House before dying in the Senate last session was described as being completely unburdened by any policy considerations and "a crazy-quilt of special-interest legislation".\(^{128}\) Debate centered on issues such as the amount of water to be reserved for areas-of-origin, the amounts and timings of taxes and fees paid, and how terms and conditions of transfers could be spelled out in statutory language rather than requiring a case-by-case permitting process.

CHAPTER 7
RESPONSE OF OTHER WESTERN STATES

It is unclear how the Arizona legislature will respond to the policy challenges raised by water farming; it is certain, however, that the issue will remain controversial until a comprehensive approach is formulated. As in other regions of the West that already have active water markets, state policy makers are scrambling to formulate policies in the midst of pressure from a variety of competing interest groups. Attempts by other western states to regulate water transfers and to mitigate third-party effects could provide valuable lessons to Arizona policy makers. The following discussion examines how other states have responded to the issues raised by water transfers.

Protecting Other Water Right Holders

Water policies in western states historically have been formulated to provide security for other water right holders. Secure water rights are important so that right holders will continue to invest in water using sectors of the economy.

Security to other water right holders is generally provided by limiting the quantity of surface water which may be transferred to historic consumptive use. This

ensures that water will continue to be available to junior appropriators who have historically relied on return flows.

Procedures governing transfers of groundwater rights, however, are not as well developed. Groundwater transfers can affect neighboring pumpers as well as other surface water right holders. While some states protect other pumpers, transfer policies often fail to recognize the hydrological connection between groundwater and surface flows.

Area of Origin Protection

Few western states have addressed comprehensively concerns raised by water transfers from rural areas. While most western states' water laws protect third-party water right holders from injury due to water transfers, consideration of area-of-origin impacts is generally not incorporated into transfer procedures. This concern is compounded because, in most western states, local governments have no formal role in the water transfer approval process. Nevertheless, western states have included a variety of measures aimed at protecting area-of-origin interests in their water transfer procedures.

Water for Future Development

Some forms of area-of-origin protection adopted by western states are aimed at assuring exporting communities an adequate water supply for the future. Early California statutes, for instance, attempted to give the area of origin the right to
recapture certain state-held water rights that are transferred to new uses (MacDonnell et al., 1985). These provisions have not been successfully invoked, however, as water importers with long-term needs, such as municipal water providers, grow dependent upon imported water and so naturally resist recapture by the area of origin. This recourse is made even more difficult because the statutes fail to clearly spell out the conditions under which recapture would be permitted.

Similarly, New Mexico statutes provide for reserving a share of a basin's water supply for use in the basin of origin, although criteria for determining what share should be reserved are not well defined (Ibid.).

Colorado law provides a more concrete approach to area-of-origin protection. Conservancy districts proposing projects which will transfer water out of basin must protect current and future consumptive water users in the exporting basin from increased future water costs. To comply with this statute importing conservancy districts typically build "compensatory storage" facilities in basins of origin. Although affording significant protection to exporting communities, this provision applies only to conservancy districts and does not protect rural areas from transfers by other entities, such as municipalities.

Compensation

Another approach to area-of-origin protection involves compensating communities for water exports. California's Burns-Porter Act, for instance, provides for compensation to northern California for water transferred south through the State
Water Project. Compensation is provided in the form of flood control funding, recreation and fisheries enhancement projects, and loans for small water-related projects (MacDonnell and Howe, 1986).

Keeping the Tax Base Whole

As in Arizona, other western states have sought to protect water exporting counties from the fiscal effects of municipally owned properties. For example, California amended its constitution in 1974 to empower local governments to tax land owned by another local government, if the lands are located in Inyo or Mono County. This amendment was intended to mitigate fiscal impacts in the Owens Valley resulting from Los Angeles' water exports.

Environmental Effects of Retired Farmland

In Colorado, where statutes do not specifically address the environmental problems associated with retired farmland, neighboring landowners have turned to negotiated settlements for protection. In the Arkansas Valley, such negotiations have resulted in water court decrees for several transfers which call for re-seeding the formerly irrigated land with native grasses. Cities purchasing irrigation water rights

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130 Amendment to California constitution Article 13, Section 11. Added November 1974. "Lands owned by a local government that are outside its boundaries, including rights to use or divert water from surface or underground sources and any other interests in lands, are taxable if (1) they are located in Inyo or Mono County and (a) they were assessed for taxation to the local government in Inyo County as of the f 1966 lien date, or in Mono County as of the f 1967 lien date, etc..."
must give the sellers notice and begin the revegetation two years before the water is diverted. Meanwhile, studies are under way to determine the most suitable grasses and revegetation methods.\textsuperscript{131}

Protecting Agricultural Interests

Idaho requires that any water transfer be evaluated against its impact on the agricultural economy, in general, and the family farm, specifically.\textsuperscript{132} Few other western states have demonstrated such a strong commitment to preserving agriculture in the face of rural-to-urban transfer pressures.

Farmers who choose to remain in agriculture rather than sell their water rights may face a variety of problems. Because irrigation systems require minimum flow levels to operate, transfers of large quantities of water out of an area threaten their viability. This is the case in the Arkansas River Valley in Colorado, where Front Range municipalities that have purchased and retired irrigated land are diverting their water upstream of remaining irrigators. This has raised fears among farmers that remaining flows will be insufficient to move water through the headgates of their diversion structures. In response to these concerns, the municipalities have agreed to maintain minimum flows near the irrigators' diversion points.\textsuperscript{133}


\textsuperscript{132} Idaho Code 42-203A and 42-229.

Other western states give special water districts veto power over transfers out of their service area. In New Mexico, for instance, transfers of water rights held in a district's name and initiated as a result of the formation of the district require approval by district authorities (Wilkinson, 1986).

Another concern is that those who choose to remain in agriculture rather than sell their water entitlement may be left to bear the repayment and operating expenses of the entire district. Requiring that water rights buyers assume the financial burden of the district members whose rights they acquire can alleviate some of the problems associated with transfers of district water.

**Division of Rural Interests**

Rural interests diverge both among farmers and among agricultural and non-agricultural sectors. Such splitting of local interests can paralyze policy decision-making at the local level and can lead to long-lasting bitterness.

Division among farmers often results when some are offered the opportunity to sell their water rights while others are not. This conflict could be mitigated if all water right holders in the area of origin had an equal opportunity to benefit from a water transfer. While this has not been accomplished through legislation, it can occur if local interests work together in dealing with water rights buyers.

An example in Utah's Lower Sevier Basin illustrates this point. In the late 1970s, the Intermountain Power Project (IPP) was interested in buying out 20 percent of the water rights held by four irrigation companies in the Lower Sevier River Basin.
To minimize conflict, IPP offered each district member an opportunity to sell up to 20 percent of her or his district water shares. Because some irrigators wished to sell more than 20 percent and some less, the option to sell to the power company became a marketable commodity (Saliba and Bush, 1987). This strategy allowed each district member to benefit from IPP's purchase by enabling those who chose not to sell any of their entitlement to market their option to sell.

Even when local irrigators are satisfied, the potential for conflict remains. Rural residents who do not hold water rights typically have no formal input in water transfer decisions that significantly affect their community. One means of providing for input is to require local public hearings on water transfers out of agriculture. In Nevada, for instance, the county commission must be notified of transfers across county lines. The commissioners then hold public hearings before making a recommendation to the State Engineer regarding transfer approval. Although the State Engineer is not bound by the county's recommendation, public hearings often increase the buyer's sensitivity to local concerns.

**Alternatives to Permanent Transfers**

A variety of strategies exist which can provide an alternative to the permanent sale of a water entitlement and the retirement of irrigated agricultural acreage. Policies designed to encourage such arrangements could promote flexible water use.

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while protecting areas of origin and environmental values. The strategies discussed below are just a sample of the innovative alternatives to permanent water transfers.

Dry-Year Options and Lease-backs

Water providers who seek a reliable backup supply for times of drought might consider dry-year options or lease-backs. Under a dry-year option, ownership of the water right remains with the original water user. The new water user simply enters into an agreement with an irrigator allowing her or him to use the water under specific conditions. Lease-backs involve the purchase of land, usually by an entity desiring long-term control of the water, and an agreement under which the land is leased back to the farmer so that agriculture can continue uninterrupted for a certain period. The new water right holder could also be a state agency and the lease-back conditioned on the need for water to support instream flows for recreation, fish, and wildlife during dry seasons and years.

Subordination Agreements

Subordination agreements, which achieve a purpose similar to that of dry-year option arrangements, entail selling the relative priority of a water right separate from the right itself. For example, the Navajo Indian, which has a senior priority claim on the San Juan River, agreed in 1968 to share shortages during droughts in exchange for obtaining federal authorization for the Navajo Indian Irrigation Project (Price and Weatherford, 1976).
Exchanging priorities also has merit among agricultural water users in areas where there is a significant difference in water values among crops. In the case of orchards, for example, a long-term investment is lost if trees die during a drought, whereas the loss of an annual crop is less dramatic. This approach has been taken in the New Mexico Pecos River Basin, where orchard owners made an exchange with field crop irrigators who had the highest seniority water rights in the area.

Exchanges

Exchanges among water sources promote water-use flexibility and conjunctive management of regional water supplies. State policies can create incentives to use surface water in years it is available, saving non-renewable groundwater supplies for times when stream flow is low. California, for example, has created formal groundwater exchange pools to promote this strategy.

Water Banking

Water banking is another strategy for enhancing water-use flexibility. This approach involves storing excess water available during high-flow years in reservoirs or underground and maintaining savings accounts to keep track of stored water. In dry years, withdrawals are made from stored supplies and the accounts debited accordingly.
Conservation Offsets

Another water reallocation strategy for junior municipal and industrial users that need more reliable supplies is to make investments in a senior use. By financing the modernization of old irrigation systems, junior users may be able to make surplus water available for their own use, while allowing the senior user to continue to irrigate the same amount of land with less water. Although the legal questions involving such arrangements are complex, this strategy is being pursued in a number of areas around the West. One way for state policy makers to promote such conservation measures is to clarify the right to market the salvaged water.

Retirement Credits

Credits for the retirement of irrigated acreage have also been proposed. In Arizona, where recent statutes limit municipal water use to curtail groundwater overdraft, the City of Tucson has sought credit for water it has "preserved" through the purchase and retirement of 16,000 irrigated acres in a valley adjacent to the city. Tucson maintains that hundreds of thousands of acre-feet of water were saved that otherwise would have been used over the 10-20 years that land has been retired.

Effective water transfer policies must provide adequate protection for important interests while allowing flexibility in water use. Before these important interests can be protected, however, they must be identified and the threat posed to

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them by water transfers evaluated. In the following chapters, a method is developed to identify the interests most vulnerable to the adverse effects of water transfers.
CHAPTER 8

OVERVIEW OF COUNTIES INDEXED

Indices which measure the relative vulnerabilities to the economic and fiscal effects of water farming will be developed for the four Arizona counties which already have experienced significant transactions in land for water rights: La Paz, Maricopa, Pima and Pinal. These counties are very different, and a brief review of their characteristics will be helpful in understanding the indices.

La Paz County

Located in western Arizona along the Colorado River, La Paz has the second smallest population (14,300) of Arizona counties (Arizona Progress, 1988). It was created in 1983 when voters in Yuma County elected to split their county. Parker, the county seat, lies midway between Phoenix and Los Angeles. Less than 5% of La Paz lands are in private ownership.

La Paz County’s economic base is agriculture, with as many as 25 different crops grown in the area (Ibid). Approximately 107,560 acres were cultivated in 1986. Cotton and alfalfa each account for about 38% of La Paz agricultural acreage, and La Paz vegetables are marketed in Phoenix and Tucson as well as nationally. Two packing plants are located in Parker, and cotton gins are located in Parker, Blythe, and Wenden (Parker Agribusiness Profile, 1988). Most of the County’s agricultural production takes place on the Colorado River Indian Reservation.
Tourism also makes a significant contribution to the county economy. The goods-producing sector accounts for only 11 percent of county employment, while government accounts for 25 percent of non-agricultural wage and salary employment, and services account for an additional 25 percent (Arizona Progress, op cit.). Unemployment in 1986 was 16.1%.¹³⁶

There has been intense water-farming activity in La Paz over the last several years. (See Table 2, Status of Land Base in Four Arizona Counties, for a summary of the water-farming activity.) In the early 1980s, Arizona Public Service purchased 12,550 deeded acres in part for the associated water. In 1984, the City of Scottsdale purchased the 8,400-acre Planet Ranch along the Bill Williams River along the county’s northern border. Later, in December 1986, the City of Phoenix purchased 14,000 acres in McMullen Valley for the associated groundwater, and the American Continental Corporation bought the 7,670-acre Crowder-Weiser Ranch, also for the groundwater.

Since then, more than 34,000 acres in the county have been purchased or are being negotiated by private developers and investors for the value of the associated water. An additional 5,400 acres of private land have been proposed for sale to the federal government for their access to water. In total, 82,148 acres, or 58 percent of what used to be privately held land, have been purchased for or are being marketed

¹³⁶ All unemployment data are from “Employment and Unemployment in State and Local Areas,” U.S. Dept. of Labor, Statistics Bureau, 1986.
TABLE 2. STATUS OF LAND BASE IN FOUR ARIZONA COUNTIES

<table>
<thead>
<tr>
<th></th>
<th>LA PAZ</th>
<th>MARICOPA</th>
<th>PIMA</th>
<th>PINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres in Private Ownership</td>
<td>82,148</td>
<td>74,800</td>
<td>40,000</td>
<td>31,607</td>
</tr>
<tr>
<td>Proposed as Water Farms (^a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Private Acreage in County</td>
<td>140,571</td>
<td>1,594,350</td>
<td>827,960</td>
<td>860,500</td>
</tr>
<tr>
<td>Water Farms as a Percent of Total Private Land</td>
<td>58%</td>
<td>4.7%</td>
<td>4.8%</td>
<td>3.7%</td>
</tr>
<tr>
<td>Cultivated Acres on Proposed Water Farms (^b)</td>
<td>23,798</td>
<td>35,000</td>
<td>23,375</td>
<td>31,607</td>
</tr>
<tr>
<td>Total Cultivated Acreage in County (1986) (^c)</td>
<td>107,561</td>
<td>471,180</td>
<td>52,351</td>
<td>323,995</td>
</tr>
<tr>
<td>Cultivated Acres on Water Farms as % of Total Cultivated Acreage</td>
<td>22.1%</td>
<td>7.4%</td>
<td>44.7%</td>
<td>9.8%</td>
</tr>
</tbody>
</table>

\(^a\) Refers to land purchased or under consideration for associated water, from Woodard, et. al., Chapter 3, 1988.

\(^b\) Currently cultivated acres on proposed water farms, from Woodard, et. al., 1988, Appendix A. Acreage also estimated based on projected municipal water demand, with the assumption that agriculture eventually will be retired on all water farm acreage.

\(^c\) U.S. Dept. of Agriculture, Agricultural Stabilization and Conservation Service. Data based on total farm acreage (excluding roads and ditches) as reported to ASCS for purposes of determining annual set aside ratios. For La Paz, Pima, and Pinal counties, data were for 1989; 1986 values were estimated by adding back in any cultivated acreage retired since then. For Maricopa County, 1986 data were available form ASCS for all program crops; data for non-program crop acreage are from 1986 Arizona Agricultural Statistics. In some instances data are not available for acreage planted in nuts and citrus.
as water farm property. Not all of this land is currently being cultivated; about 22 percent of the acreage cultivated in 1986 is involved in water-farm transactions.

Several factors combine to make La Paz County property attractive for water farming. The CAP canal runs through the county on its way to Arizona's urban centers, providing a possible transport route for the water from the water farms to the cities. Additionally, the county is not included in an Active Management Area (AMA) and is not subject to the intense management and quantification of rights mandated for these areas.

**Maricopa, Pima and Pinal Counties**

The other three counties for which indices will be computed include three of the state's Active Management Areas. In these areas, transferrable rights to pump groundwater are based on pre-1980 uses. Under the Groundwater Management Act, land within an AMA which was irrigated between 1975 and 1980 was eligible for an irrigation grandfathered right (IGR). In order to transfer these rights, the owner of the IGR may retire the irrigated land and convert the IGR to Type I non-irrigation rights. Water pumped under a Type I right must be withdrawn from the originally irrigated land, but may be used for non-irrigation purposes on any lands. Another important provision of the GWMA is the requirement that new subdivisions within an AMA demonstrate a 100-year assured water supply before lots are put on the market.
Maricopa County

Maricopa County includes the Phoenix AMA as well as lands to the west and south of the AMA. In 1986, approximately 471,000 acres were cultivated in Maricopa County. More cotton, wheat, barley, sorghum, corn, hay, and vegetables are grown in Maricopa County than in any of the other indexed counties (1986 Arizona Agricultural Statistics, 1987). Nevertheless, agricultural employment accounts for less than one percent of Maricopa payrolls. Services account for a quarter of county payrolls, closely followed by manufacturing and trade. (See Table 3, Percentage of County Payrolls in Each Sector).

Maricopa County contains all Arizona municipalities with populations over 50,000, except for Tucson. These include Glendale, Mesa, Phoenix, Scottsdale, and Tempe. Total county population in 1980 was 1,509,262 (County Business Patterns, 1986). The county also contains the Salt River Reservation, the Gila Bend Reservation, the Fort McDowell Reservation, and some of the Gila River Reservation.

All or part of Chandler, Gilbert, Glendale, Mesa, Peoria, Phoenix, Scottsdale, and Tempe are served municipal and irrigation water by the Salt River Project (SRP), the oldest of the Bureau of Reclamation projects. The SRP delivered 1.2 million acre-feet per year on average between 1954 and 1984, 28 percent of which was Maricopa County groundwater and 72 percent of which was surface water from the SRP's extensive system of reservoirs. SRP deliveries are limited to within the project's boundaries, however, and areas under development in the Phoenix AMA
TABLE 3. PERCENTAGE OF COUNTY PAYROLLS IN EACH SECTOR

<table>
<thead>
<tr>
<th>Sector</th>
<th>Maricopa</th>
<th>Pima</th>
<th>Pinal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Services, Forestry, and Fisheries</td>
<td>0.5%</td>
<td>0.6%</td>
<td>Db</td>
</tr>
<tr>
<td>Mining</td>
<td>0.2%</td>
<td>1.8%</td>
<td>D</td>
</tr>
<tr>
<td>Contract Construction</td>
<td>10.9%</td>
<td>11.3%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>23.4%</td>
<td>24.5%</td>
<td>19.8%</td>
</tr>
<tr>
<td>Transportation and Other Public Facilities</td>
<td>7.2%</td>
<td>5.6%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>8.0%</td>
<td>5.2%</td>
<td>D</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>13.7%</td>
<td>14.8%</td>
<td>13.9%</td>
</tr>
<tr>
<td>Finance, Insurance, and Real Estate</td>
<td>10.9%</td>
<td>8.1%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Services</td>
<td>25.2%</td>
<td>26.9%</td>
<td>10.2%</td>
</tr>
<tr>
<td>TOTAL % 'S</td>
<td>100%</td>
<td>98.8%</td>
<td>55.8%</td>
</tr>
<tr>
<td>Unemployment Rate^c</td>
<td>5.6%</td>
<td>5.7%</td>
<td>12.1%</td>
</tr>
</tbody>
</table>


^b. "D" denotes figures withheld to avoid disclosing data for individual companies.

that lie outside the boundaries of SRP must find alternative water sources for the 100-year assured water supply required by the GWMA.

Developers and municipalities have sought to satisfy these requirements with agricultural water within the county as well as with imported water from rural counties like La Paz and Pinal. A total of 83,358 acres of farmland in Maricopa County have been purchased or offered for sale for their water rights; some of these lands will be included in urban developments, leaving 74,800 acres of potential water farms that will simply be retired from agricultural use. About 35,000 acres are currently being cultivated on these lands. For the purpose of constructing a comparable index of sensitivity to economic effects of water farming, the effects on county incomes of retirement of irrigated acreage will be calculated without introducing a compensating value for the (unquantified but large) economic benefits of future development on the retired lands. These benefits need to be included in any assessment of the effects of the retirement of water farms on future development.

Pima County

Pima County, in the Sonoran Desert of southcentral Arizona, has the second largest population of Arizona counties (531,443 in 1980) (Ibid.). Most of the Tucson AMA, as well as the city of Tucson, is contained within the county. Tucson began buying agricultural acreage for its water in 1971, before the passage of the GWMA, and now owns about 22,878 acres in the Avra Valley, 15 miles northwest of the city. Approximately 20,575 acres were cultivated prior to their purchase.
Tucson has considered buying the remaining 20,000 acres in the valley over the next couple of decades. Whether it does will depend to a large degree on how Arizona policy makers ultimately legislate water transfers and how much of the converted IGRs can count towards the city's assured water supply. For the purpose of constructing the economic index, it is assumed that Tucson will continue purchasing Avra Valley farmland according to its original plan. Thus, the "worst case scenario" is considered in measuring Pima County's sensitivity to the adverse effects of water farming.

Tucson has also proposed to lease some of the Central Arizona Project water to be delivered to the Tohono O'odham Nation, part of which lies within the Tucson AMA. Tucson has not yet purchased any agricultural lands outside the county for water rights. Thus far, it has no concrete plans to do so, but considers such an import a possible element in its water management plan. The city has recently been considering water farm purchases in the Wilcox and Douglas basins in the southeast part of the state. The city has worked to keep this option open despite considerable opposition from water interests in that area as well as from environmentalists throughout the state who are concerned with the prospect of transfers from the state's few remaining basins with surface water flows.

The purchases of land that have been completed or proposed in Avra Valley will retire nearly half of the cultivated acres in Pima County. Approximately 52,000 acres were cultivated in 1986 in Pima County. Cotton accounts for 66 percent of
Pima County production, wheat for 18 percent, with the remainder divided among barley, sorghum, hay, and lettuce (1986 Arizona Agricultural Statistics, 1987).

Agricultural wages were less than one percent of Pima County payrolls in 1986. Over a quarter of wages paid in the county were in the services sector, nearly a quarter in manufacturing, and almost 15 percent in retail trade (see Table 3) (County Business Patterns, 1986). Unemployment in 1986 was 5.7 percent.

Pinal County

Pinal County contains most of the Pinal AMA and parts of both the Phoenix and Tucson AMAs. Pinal's 1980 population was 90,918 (Ibid.). An essentially agricultural county lying between Phoenix and Tucson, Pinal expects to become part of the "urban corridor" that is already beginning to unite the two metropolitan areas. Casa Grande, Eloy, Coolidge, and Florence are centers for the surrounding agricultural communities. The county contains the Central Arizona, Hohokam, San Carlos, and Maricopa-Stanfield Irrigation and Drainage Districts.

Prior to water-farm purchases in the county, average cultivated acreage was about 324,000 acres, with roughly two-thirds in cotton and the rest in hay, wheat, barley, sorghum, corn, and some vegetables and melons (1986 Arizona Agricultural Statistics, 1987). While wages in agriculture are not reported separately for Pinal County in the 1985 Census, 44.2 percent of county payrolls are in agriculture, mining, and wholesale trade combined. It is assumed that a significant share of this employment must be agricultural, particularly because mining is in decline in the
county. Manufacturing accounts for a little less than 20 percent of the county payrolls (see Table 3). Unemployment in 1986 was 12.1 percent.

The annual overdraft of groundwater within the Pinal AMA is currently over one million acre-feet per year. It is expected to decrease to about 430,000 acre-feet per year by 2025 in accordance with the AMA's management plan; however, Pinal will have used two-thirds of its currently recoverable groundwater stocks by then, and annual pumpage will have to continue to decline as stocks are exhausted. Water levels have fallen from about 50 feet deep in 1923 to between 300 and 500 feet within the AMA, a decline of 250 to 450 feet.

In 1985, the city of Mesa purchased 11,607 acres with grandfathered irrigation rights in Pinal County with the intention of retiring the land and converting the rights to Type I rights. Mesa plans to pump the water into the CAP canal near Picacho Reservoir, sending the water to Tucson in exchange for Tucson's allowing Mesa to take an equivalent amount of Tucson's CAP allotment from the canal above Pinal County. Before Phoenix's purchase of McMullen Valley, various Maricopa County cities discussed purchasing an additional 20,000 acres of Pinal County farmland. These proposals may be revived if problems arise with exporting water from La Paz County.
CHAPTER 9
ECONOMIC INDEX

Introduction to Indices

Estimation of the actual changes in county incomes as a result of reduced agricultural acreage requires an econometric model of the county economy specifying the relationship of incomes in each sector to crop sales and to incomes in all other sectors, an input/output model, or an export-base model relying on surveys. Similarly, rigorous quantification of the effects on a county's fiscal capacity from reductions in the tax base is a complicated and data-intensive process. These relationships are almost certain to be nonlinear and complex, and the data necessary for such models are not readily available.

This research seeks only to compare the relative sensitivity of four Arizona counties to reductions in cultivated acreage and removal of land from the tax base. Rather than quantifying or forecasting the actual changes to a county's economic or fiscal capacity in response to water farming, this research attempts to measure the relative changes among counties. To emphasize the relative nature of the measure, it is expressed as an index. This involves constructing a ratio, wherein the value for the particular characteristic of each county is divided by the value for the base case (in this instance, Pima County).
Constructing the Economic Index

A two-part index is created to assess the counties' relative sensitivity to economic effects using county incomes as a measure of economic vitality. As noted above, the economic effects of water farming result from the retirement of cultivated acreage and include direct effects (reduced farm incomes), indirect effects (reduced incomes in farm services and input sales), and induced effects (reduced local incomes as a result of reduced expenditures by those whose incomes come from agriculture).

The two elements of the index are:

1. a measure of the relative sensitivity of total county incomes to declines in agricultural acreage (i.e., diversity of the local economy); and
2. the percentage of the county's total agricultural acreage being considered for retirement due to water farming.

The combination of these two elements yields a county's overall sensitivity to the economic effects of water-farming activity relative to the other counties indexed.

The economic index is derived from the following basic equations:

\[
\frac{\text{County Income from Ag and Ag-related Sources}}{\text{Total County Income}} \quad (1A)
\]
The index is constructed by breaking cash marketings in agriculture, using state-wide data, into income and expenditure categories. Changes in county personal income are then imputed on the basis of percentage marketings in these classes. Because of (a) the use of state-wide relations and (b) the use of averages over an eight-year period, the imputed changes do not forecast or measure actual changes, but should measure relative changes among counties. The results are divided by the value for Pima County, yielding an index which may be used to compare the degree of shock to a regional economy represented by the retirement of agricultural acreage.

Imputed Agricultural Incomes

The first step in calculating the economic index is to calculate direct and indirect agricultural incomes. Because these are not available in published data, values for direct and indirect agricultural incomes in each county are imputed in the following way. It is assumed that, in each county, the returns to the farm operator as well as expenditures on farm inputs and services--fertilizer, pesticides, farm equipment, repair and operations, farm labor, and machine hire and customwork--are the same percentage of cash marketings as for the state as a whole. Using data for
the state as a whole from 1978 to 1985, the average percentage of cash marketings attributable to each of these categories is calculated (See Table 4, Farm Expenditures as Percent of Farm Marketings). The eight-year average is used to absorb annual differences due to crop prices, government programs, and weather.

**Imputed Direct Agricultural Income.** Direct income includes the returns to operators and the wages of agricultural workers; 29 percent of each county’s average cash marketings over the reported period (1981-1985 for Maricopa, Pima and Pinal, 1983-1985 for La Paz\(^{137}\)) is counted as imputed direct agricultural income in the county. These figures are reported in Table 5, Imputed County Incomes Attributable to Agriculture.

**Imputed Indirect Agricultural Income.** Indirect incomes arise from expenditures on sales and services to agricultural operators. Expenditures on inputs are initially estimated using the state-wide percentage applied to average county cash marketings (see Table 4). Incomes arising from these expenditures are estimated using the state-wide average ratio of payrolls to sales (12 percent) for expenditures on fertilizer and lime, pesticides, and capital consumption, and the state-wide ratio of payroll to services (37 percent) for expenditures on machine hire and customwork and repair and operation (Charney, 1988a). Farmers in counties with no metropolitan center are more likely to purchase inputs and capital equipment out-of-county. Therefore, the 12 percent payroll to sales ratio should, for these counties, be applied

\(^{137}\) Because La Paz County was not created until 1983, data on the county’s cash marketings are not available prior to this year.
TABLE 4. FARM EXPENDITURES AS PERCENT OF FARM MARKETINGS\textsuperscript{a}

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Returns to Operators</td>
<td>17%</td>
</tr>
<tr>
<td>Contract and Hired Labor</td>
<td>12%</td>
</tr>
<tr>
<td>Fertilizer and Lime</td>
<td>3%</td>
</tr>
<tr>
<td>Pesticides</td>
<td>4%</td>
</tr>
<tr>
<td>Capital Consumption</td>
<td>11%</td>
</tr>
<tr>
<td>Machine Hire and Customwork</td>
<td>12%</td>
</tr>
<tr>
<td>Repair and Operation</td>
<td>9%</td>
</tr>
<tr>
<td>Other and All Assumed to Leak\textsuperscript{b}</td>
<td>32%</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Data from 1986 Arizona Agricultural Statistics, Farm Income Indicators: Arizona, 1978-1985, p. 4-5, 8-year average in each category divided by Farm Marketings.

\textsuperscript{b} This refers to expenditures in categories not included here and any expenditures made out-of-county.
TABLE 5. IMPUTED COUNTY INCOMES ATTRIBUTABLE TO AGRICULTURE ($1,000)

<table>
<thead>
<tr>
<th></th>
<th>LA PAZ</th>
<th>MARICOPA</th>
<th>PIMA</th>
<th>PINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IMPUTED DIRECT AGRICULTURAL INCOMES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Returns to Operators</td>
<td>11,836</td>
<td>112,320</td>
<td>8,484</td>
<td>49,014</td>
</tr>
<tr>
<td>Wages and Contract Labor</td>
<td>8,162</td>
<td>77,448</td>
<td>5,850</td>
<td>33,797</td>
</tr>
<tr>
<td><strong>TOTAL DIRECT INCOMES</strong></td>
<td>19,998</td>
<td>189,768</td>
<td>14,334</td>
<td>82,811</td>
</tr>
<tr>
<td><strong>IMPUTED INDIRECT AGRICULTURAL INCOMES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales of Fertilizers and Pesticides</td>
<td>718</td>
<td>6,810</td>
<td>514</td>
<td>2,972</td>
</tr>
<tr>
<td>Sales of Capital Equipment</td>
<td>1,128</td>
<td>10,702</td>
<td>808</td>
<td>4,670</td>
</tr>
<tr>
<td>Repair and Operation</td>
<td>2,252</td>
<td>21,369</td>
<td>1,614</td>
<td>9,325</td>
</tr>
<tr>
<td>Machine Hire and Custom Work</td>
<td>3,263</td>
<td>30,967</td>
<td>2,339</td>
<td>13,513</td>
</tr>
<tr>
<td><strong>TOTAL INDIRECT INCOMES</strong></td>
<td>7,361</td>
<td>69,847</td>
<td>5,276</td>
<td>30,480</td>
</tr>
<tr>
<td><strong>IMPUTED INCOMES INDUCED BY AGRICULTURAL</strong></td>
<td>3,283</td>
<td>49,327</td>
<td>3,530</td>
<td>13,595</td>
</tr>
<tr>
<td><strong>TOTAL IMPUTED AGRICULTURE-RELATED INCOME</strong></td>
<td>30,642</td>
<td>308,942</td>
<td>23,140</td>
<td>126,886</td>
</tr>
<tr>
<td><strong>TOTAL PERSONAL INCOME</strong></td>
<td>116,300</td>
<td>22,633,600</td>
<td>6,915,500</td>
<td>833,800</td>
</tr>
<tr>
<td><strong>IMPUTED AG-RELATED INCOME AS % OF TOTAL PERSONAL INCOME</strong></td>
<td>26%</td>
<td>1.36%</td>
<td>0.33%</td>
<td>15%</td>
</tr>
<tr>
<td><strong>INDEX OF RELATIVE SENSITIVITY TO DECLINES IN AGRICULTURE</strong></td>
<td>79</td>
<td>4</td>
<td>1</td>
<td>45</td>
</tr>
</tbody>
</table>


b. Imputed ag-related income as a percent of total personal income for each county, divided by 0.33%, the values for Pima County.
to a smaller base. These are the same counties in which agriculture contributes a major share to total county income, so there is particular concern about avoiding an upward bias when imputing agricultural incomes for these counties. Unfortunately, data are not available on the percent of expenditures made out-of-county. In order to guarantee that upward bias is absent, all expenditures for La Paz and Pinal counties are assumed to be made out-of-county, while for Maricopa and Pinal counties, all were assumed to be made in-county. Services, however, are assumed to be in-county for all counties indexed. An additional 3 percent is added to each category for proprietor's incomes. Sales of fuel oil, electricity, and interest were not considered to have significant contributions to indirect incomes. Imputed indirect agricultural incomes are reported in Table 5.

Imputed Incomes Induced by Agriculture. Incomes induced by agriculture arise from local expenditures by those whose incomes come from agriculture. Induced incomes for Maricopa and Pima counties are imputed based on the fixed-population income multiplier for these counties (1.19 and 1.18, respectively), while those for La Paz and Pinal counties were based on the fixed-population income multiplier for "balance-of-state" (1.12) (Charney, 1988b). This multiplier is applied to imputed direct and indirect incomes for each county (see Table 5). As discussed above, this multiplier is smaller for rural counties where a larger share of incomes typically are spent out-of-county.
Sensitivity of County Incomes to Declines in Agriculture

The first element of the economic index is obtained by calculating the percent of total county income made up by imputed agriculture-related income for each county. Using the percentage for Pima County as a base, the dependence on agriculture for each other county is related to Pima County. On this basis, La Paz County income is 79 times more dependent on agriculture than Pima County income, Pinal County income is 45 times more dependent, and Maricopa County income only 4 times more dependent on agriculture than Pima County (see bottom line of Table 5).

Impact of Water Farms on Cultivated Acreage

The second element of the economic index should assess the relative demand for water farms as a percentage of cultivated acreage in the county. Because the type of land which is considered suitable for water farming changes radically over time, only land which has already been purchased, land on which offers have been made, and land under active consideration for purchase is counted as land "considered for retirement" for its water. This means that this portion of the index will vary with the current market climate and should be re-evaluated as that climate changes and brings more land into or out of this category. The computation of the percent of cultivated acres considered for retirement is shown on line 3 of Table 6.
TABLE 6. EFFECT ON COUNTY INCOME OF DEMAND FOR WATER FARMS

<table>
<thead>
<tr>
<th></th>
<th>LA PAZ</th>
<th>MARICOPA</th>
<th>PIMA</th>
<th>PINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.  TOTAL CULTIVATED ACRES</td>
<td>107,561</td>
<td>471,180</td>
<td>52,351</td>
<td>323,995</td>
</tr>
<tr>
<td>IN COUNTY (1986)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.  CULTIVATED ACRES</td>
<td>23,798</td>
<td>35,000</td>
<td>23,375</td>
<td>31,607</td>
</tr>
<tr>
<td>CONSIDERED FOR RETIREMENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.  PERCENT OF TOTAL</td>
<td>22.1%</td>
<td>7.4%</td>
<td>44.7%</td>
<td>9.8%</td>
</tr>
<tr>
<td>CULTIVATED ACREAGE PROPOSED FOR RETIREMENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.  IMPUTED LOSS IN AG-</td>
<td>6,780</td>
<td>22,949</td>
<td>10,332</td>
<td>12,378</td>
</tr>
<tr>
<td>RELATED INCOMES DUE TO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RETIREMENT* ($1,000)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.  IMPUTED LOSS AS PERCENT</td>
<td>5.83%</td>
<td>0.10%</td>
<td>0.15%</td>
<td>1.48%</td>
</tr>
<tr>
<td>OF COUNTY INCOME*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.  INDEX OF RELATIVE</td>
<td>39</td>
<td>0.7</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>SENSITIVITY TO DEMAND</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOR WATER FARMS*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. From Table 2. Woodard, et. al., 1988, Appendix A.
c. Assumes a one-percent reduction in cultivated acreage due to retirement causes a one-percent reduction in (imputed) agricultural-related incomes. Equal to (Total Imputed Agriculture Related Incomes from Table 5 x Line 3)/100.
d. Equal to (Line 4/Total County Income) x 100.
e. Imputed loss as a percentage of total county income for each county divided by 0.15%, the value for Pima County.
Sensitivity to Demand for Water Farms

Finally, the information generated on agriculture's importance to total county incomes is combined with information on the potential impact of water farms on cultivated acreage to yield an index of economic sensitivity to demand for water farms. Assuming that the retirement of one percent of cultivated lands results in a loss of one percent of agricultural incomes, the fraction of county cropped acreage proposed for retirement for water farms is multiplied by the value of total imputed agriculture-related incomes to give an estimate of imputed loss in agriculture-related incomes due to retirement of water farm acreage. Note that because the linearity restrictions on the relation between retirement and loss of incomes compound the restrictive assumptions made in calculating agriculture-related incomes, the imputed loss estimated here is not a good estimate of actual declines in county incomes. It is expected, however, that any bias will affect all the indexed counties in a similar manner, so that the estimate of imputed loss as a percentage of total county income (line 5, Table 6) maintains a realistic relationship among the counties. If this is the case, the relative percentage loss from county to county should provide a comparison of the counties' sensitivity to demand for water farms. This relative percentage loss is reported in line 6, Table 6, again using Pima County as a base. La Paz is shown to be 39 times more sensitive to the economic effects of existing demand for water farms than Pima; Maricopa only 0.7 times as sensitive; and Pinal ten times as sensitive.
Summary

The index of sensitivity to the economic effects of water farming calculated here has two parts. The first part measures the relative vulnerability of county incomes to retirement of agricultural production, from whatever cause. This can be taken as a measure of the potential severity of the effects on the local economy of an increase in water-farming activity. The second part measures the relative vulnerability of county incomes to current or proposed transactions in water farms—the effects captured in the first part of the index are, essentially, weighted by the relative percentage of local cultivated lands being considered as water farms. This can be taken as a measure of the relative impact on county incomes of current water-farming activity. These two indices are reported together in Table 7, Indices of Relative Sensitivity of County Incomes to Potential and Actual Water Farming Activity.
TABLE 7. INDICES OF RELATIVE SENSITIVITY OF COUNTY INCOME TO POTENTIAL AND CURRENT WATER FARMING ACTIVITY.\textsuperscript{a}

<table>
<thead>
<tr>
<th></th>
<th>LA PAZ</th>
<th>MARICOPA</th>
<th>PIMA</th>
<th>PINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>INDEX OF RELATIVE</td>
<td>79</td>
<td>4</td>
<td>1</td>
<td>45</td>
</tr>
<tr>
<td>SENSITIVITY OF COUNTY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INCOME TO POTENTIAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WATER FARMING ACTIVITY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INDEX OF RELATIVE</td>
<td>39</td>
<td>0.7</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>SENSITIVITY OF COUNTY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INCOME TO CURRENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WATER FARMING ACTIVITY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{a} Pima County = 1.0.
CHAPTER 10
DIRECT FISCAL INDEX

Introduction

The fiscal effects of water farming result primarily from constitutional exemptions of municipally owned land from taxation. Because property tax is a major revenue source for local governments, the removal of land from the tax base impairs a county's fiscal capacity. It does so by reducing the county's net assessed valuation, which in turn decreases the county's bonding capacity and legal debt limit. Net valuation is also the basis for the distribution of state-shared revenues. Furthermore, local revenues, both direct and through state-local revenue sharing, will be affected as less money circulating through the county reduces taxable transactions.

A similar approach is employed for measuring the relative severity of the direct fiscal effects of water farming as was used for the economic effects. An index is created which measures a county government's relative sensitivity to the direct fiscal impacts of the removal of agricultural acreage from its tax base. The index contains the following elements:

(1) the percentage contribution of agricultural lands to the county's total tax base; and

(2) the percentage contribution of municipally owned water farm acreage to total agricultural acreage.
The combination of these two elements yields the overall sensitivity of a county's tax base to municipally owned water farms. Because a county's total revenue is derived from sources other than property taxes, a final part of the fiscal index considers the percentage contribution of municipally owned water farms to the county's total revenues.

The following basic equations are used to construct the fiscal index:

\[
\frac{\text{Valuation of Ag Properties}}{\text{Total Valuation of County}} \quad (1D)
\]

\[
\frac{\text{Valuation of Municipal Water Farms}}{\text{Valuation of All Ag Properties}} \quad (1E)
\]

\[
\frac{\text{Valuation of Ag Properties} \times \text{Value of Municipal Water Farms}}{\text{Total Valuation of County} \times \text{Value of All Ag Properties}} \quad (1F)
\]

The fiscal analysis presented here deals only with the direct fiscal impacts associated with the loss of municipally held land from the tax rolls. The analysis does not attempt to account for indirect or induced fiscal impacts which may also result from water-farm purchases by municipalities. Examples of indirect fiscal impacts not included here are losses of tax revenues which may occur when agricultural-related businesses are affected by the retirement of irrigated agriculture on water farms. These effects would be felt whether the water farms were privately or municipally owned. Other induced, or population and income-related effects, would be experienced if water-farming activity resulted in the general decline of the
county's economy, as this decline would in turn depress land values and lower incomes in the area.

Losses to county tax revenues are not estimated in this analysis for municipally owned personal property and improvements on state lands, the leases of which were purchased by municipalities. While potentially significant, the data needed to estimate these losses with a reasonable degree of confidence are not available. Furthermore, only losses to the county government itself were considered when constructing the direct fiscal index. Other losses, to the state, towns, community colleges, school districts, and special districts such as fire and irrigation districts, are discussed in a later chapter.

A brief explanation of Arizona's taxation and land valuation systems is useful in understanding the components of the fiscal index.

**Arizona's Taxation and Land Valuation Systems**

As noted above, local governments in Arizona generate revenues from several sources, the most important source being property taxes. Other sources of county revenues include state-shared revenues, such as sales tax and highway funds, and user charges, such as building permits and inspection fees.

Amendments to the Arizona Constitution in 1980 created two separate tax systems: (1) a primary system for taxes levied to pay for current operation and maintenance expenditures, based on Limited Property Values (LPV), and (2) a secondary system for taxes levied to pay principal and interest on bonded indebted-
ness, voter-approved budget overrides, and special district assessments. The secondary system is based on Full Cash Value (FCV).

Full Cash Value

Full Cash Value is set at from 80 to 95 percent of fair market value. The FCV of a parcel remains the same from year to year, provided there are no modifications or changes of use. If the value of the land increases, however, the FCV is raised to reflect the added value.

Limited Property Value

Several formulas are used to determine Limited Property Value. For parcels subject to modifications or changes in use, LPV is established by applying a ratio of FCV to LPV of existing properties of the same use or legal classification. The LPV of properties which do not undergo modifications or changes in use increase annually either by 10 percent, or by 25 percent of the difference between the previous year's LPV and the current FCV, whichever is greater. The LPV can equal but never exceed the FCV.

Primary and Secondary Assessed Valuations

Tax rates are based on assessed valuations, with primary tax rates based on Primary Assessed Valuation (PAV) and secondary tax rates based on Secondary Assessed Valuation (SAV). PAV is derived by multiplying the assessment ratio
corresponding to the parcel's legal class by its LPV. Similarly, SAV is derived for the parcel by applying the same assessment ratio to its FCV.

Legal Class

In Arizona, all property, both real and personal, is assigned a legal classification based on the use of the property. The assessment ratios corresponding to legal classes are reported in Table 8.

Agricultural land is of primary concern in measuring the fiscal effects of water farming. Under Arizona law, agricultural property is defined as real and personal property used for the purpose of agronomy, horticulture, or animal husbandry. Two additional criteria for classification as agricultural property are:

1. that the primary function of the property is to produce an agricultural crop or commodity; and
2. that the property is used with a reasonable expectation of profit solely from its agricultural use.

Pursuant to statute\textsuperscript{138}, agricultural land, as of 1981, is to be valued using solely the income approach without any allowance for urban or market influences. The income of the property is to be determined using the capitalized average annual net cash rental.

\textsuperscript{138} Ariz. Rev. Stat. § 42-123.
<table>
<thead>
<tr>
<th>LEGAL CLASS</th>
<th>ASSESSMENT RATIO</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>30%</td>
<td>Includes producing mines and mining claim property and standing timber.</td>
</tr>
<tr>
<td>Class 2</td>
<td>30%</td>
<td>Includes property used to provide local telecommunications service, gas, water, and electric.</td>
</tr>
<tr>
<td>Class 3</td>
<td>25%</td>
<td>Includes commercial and industrial property not included in other classes.</td>
</tr>
<tr>
<td>Class 4</td>
<td>16%</td>
<td>Consists mainly of agricultural properties and vacant land.</td>
</tr>
<tr>
<td>Class 5</td>
<td>10%</td>
<td>Composed of residential property not used for profit (owner occupied).</td>
</tr>
<tr>
<td>Class 6</td>
<td>15%</td>
<td>Contains leased or rented residential property</td>
</tr>
<tr>
<td>Class 7</td>
<td>24%</td>
<td>Includes railroad operating property.</td>
</tr>
<tr>
<td>Class 8</td>
<td>5%</td>
<td>Comprised of historic property.</td>
</tr>
<tr>
<td>Class 9</td>
<td>12%</td>
<td>Consists of scenic or historic railroad property.</td>
</tr>
<tr>
<td>Class C</td>
<td>100%</td>
<td>Comprised of producing oil and gas company property.</td>
</tr>
</tbody>
</table>
Constructing the Direct Fiscal Index

Because fiscal impacts are strongly felt only when land is removed from the tax base, private water-farm acreage was not considered when constructing this index. The fiscal index differs significantly from the economic index in this important respect. A scenario was not constructed here for how much private water-farm acreage would later be sold to municipalities or how much would remain in private ownership. Consequently, only existing municipal water-farm acreage is considered and no attempt is made to predict the extent of future municipal water-farm purchases when constructing the direct fiscal index.

Changes in county fiscal capacity are measured relative to 1984, because water-farm purchases in all of the indexed counties, with the exception of Pima County, began immediately after this year. In this respect, 1984 provides a "snap shot" of the counties prior to water-farm purchases. In Pima County, municipal water-farm purchases began in the early 1970s and continued until the mid-1980s. Comparison over several years would be difficult because the form in which county fiscal data were reported for Pima County varies considerably over this time period. Furthermore, tax policies for all Arizona counties have changed radically since the early 1970s. Although other changes in assessed valuation and county revenues have occurred since then, only those caused by municipal water-farm purchases are of

139 In some instances, a developer who owns a water farm may transfer it to a city in exchange for Assured Water Supply Credits for development within the AMA. Others (i.e., Agricom Management Inc.) have planned to become water purveyors, selling water to AMA municipalities while retaining title to the water farms.
interest here. The use of data for fiscal year 1984 allows ready comparison between Pima County data and that of the other indexed counties.

Sensitivity of Assessed Valuation

Assessed valuation, as the basis for setting tax rates, distributing state-shared revenues, and determining a county's bonding capacity, is taken here as a measure of overall fiscal capacity.

**Importance of Agricultural Lands to Assessed Valuation.** The first element of the fiscal index measures the percentage contribution of agricultural lands to primary assessed valuation of the entire county (Total County PAV). This will yield a relative measure of the sensitivity of a county's PAV to the removal of agricultural land from the tax base for any reason. Because county fiscal data for agricultural lands are reported together with vacant lands as Class 4 lands, fiscal data for Class 4 lands will be used here as representative of agricultural lands.

The PAV for Class 4 lands (Class 4 PAV) and for Total County PAV are shown on lines 1 and 2 of Table 9, as reported in county financial reports. Next, Class 4 PAV is taken as a percent of Total County PAV (line 3, Table 9). Using the percentage for Pima County as a base, the importance of Class 4 lands to each county's PAV is related to Pima County, yielding an index of relative sensitivity of assessed valuations to the removal of agricultural land from the tax base (line 4, Table 9). These values show that, while Class 4 PAV in Maricopa is many times larger than in other counties, Class 4 lands make up a smaller portion of the
TABLE 9. EFFECT ON ASSESSED VALUATION OF LOSS OF AGRICULTURAL LAND FROM THE TAX BASE

<table>
<thead>
<tr>
<th></th>
<th>LA PAZ</th>
<th>MARICOPA</th>
<th>PIMA</th>
<th>PINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. CLASS 4 PAV(^a) ($)</td>
<td>9,585,556</td>
<td>421,505,080</td>
<td>173,487,991</td>
<td>57,638,920</td>
</tr>
<tr>
<td>2. TOTAL COUNTY PAV(^b) ($)</td>
<td>61,219,257</td>
<td>5,915,024,361</td>
<td>2,062,900,770</td>
<td>296,135,865</td>
</tr>
<tr>
<td>3. CLASS 4 PAV AS % OF TOTAL COUNTY PAV(^c)</td>
<td>15.7%</td>
<td>7.1%</td>
<td>8.4%</td>
<td>19.5%</td>
</tr>
<tr>
<td>4. INDEX OF SENSITIVITY TO LOSS OF AG LAND FROM TAX BASE(^d)</td>
<td>1.9</td>
<td>0.8</td>
<td>1.0</td>
<td>2.3</td>
</tr>
</tbody>
</table>

\(^a\) Values for 1984, from 1984 State and County Abstract of the Assessment Roll, Arizona Department of Revenue, Division of Property, Central Information Services Section, Phoenix, Arizona. (602) 255-5175

\(^b\) Ibid.

\(^c\) Equal to (Class 4 PAV/Total County PAV) x 100.

\(^d\) The percentage contribution of Class 4 PAV to Total County PAV divided by 8.4%, the value for Pima County.
Maricopa tax base. Pima Class 4 PAV is 18 times greater than that of La Paz, but the share of Class 4 lands in Total PAV is almost twice as great in La Paz as in Pima. Similarly, Pinal County's Total County PAV is 2.3 times more dependent on Class 4 lands than is that of Pima County, and Maricopa County 0.8 times.

Impact of Water Farms on Assessed Valuation. The second element of the fiscal index, the relative percentage contribution of PAV of municipal water-farm acreage (Water Farm PAV) to total Class 4 PAV, measures the relative impact of water farms on assessed valuation. Because only existing municipal water farms are considered here, this element should be re-evaluated as future municipal acquisitions are made.

Assessed Valuation Per Acre of Agricultural Land. First, the average assessed valuation per acre of agricultural land is needed for each county. Because assessed valuations of agricultural land are not reported separately from other lands, average PAV and SAV per acre of agricultural land (PAV and SAV/Acre Ag) were estimated for each county based on 1988 data obtained from the offices of the County Assessors.

For La Paz and Pima counties, the total assessed valuations, both primary and secondary, were available for total municipal water-farm acreage. The respective averages were estimated simply by dividing the PAV and SAV by total water-farm acreage. For Pinal County, only values for Full Cash Value (FCV) and Limited Property Value (LPV) per acre were available for the municipal water farm acreage. To estimate average PAV and SAV/Acre Ag, the LPV and FCV, respectively, are
multiplied by 16 percent, the assessment ratio for agricultural land. These estimated averages are assumed to be representative of agricultural land throughout the respective counties. For Maricopa County, which has no municipally owned water-farm acreage, average assessed values were estimated based on data for all farm land in the county. Data on the total amount of agricultural acreage were combined with data on the FCV of all farm land to yield an estimated average PAV and SAV/Acre Ag.140

The estimated average PAV and SAV/Acre Ag for each county are reported in lines 1 and 2 of Table 10. PAV/Acre Ag is on average highest in La Paz, followed by Maricopa, Pinal, then Pima. SAV/Acre Ag, however, is highest in Maricopa County, followed by Pima, La Paz, and finally Pinal.

Assessed Valuation of Water-Farm Acreage. The total PAV of municipal water-farm acreage (Water Farm PAV) for each county is estimated by multiplying the average PAV/Acre Ag for each county by the total number of municipal water-farms acres. Total Water Farm PAV is reported in line 4 of Table 10.

Sensitivity to Current Demand for Water Farms. Finally, the information generated on agriculture's importance to net assessed valuation is combined with information on the potential impact of water farms on assessed valuation of

140 Total agricultural acreage and total FCV for the real property component were available from the Land Department of the Assessors Office. FCV for the personal property component of all agricultural land was available from the Personal Property Department. These values were combined to get total FCV. The LPV was then estimated using a LPV to FCV ratio of 0.67, derived from 1984 Class 4 lands as reported in the Abstract of the Assessment Rolls.
### TABLE 10. EFFECT ON ASSESSED VALUATION OF CURRENT MUNICIPAL WATER FARMING ACTIVITY

<table>
<thead>
<tr>
<th></th>
<th>LA PAZ</th>
<th>MARICOPA</th>
<th>PIMA</th>
<th>PINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. AVERAGE PAV/ACRE AG&lt;sup&gt;a&lt;/sup&gt; ($)</td>
<td>86</td>
<td>84</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>2. AVERAGE SAV/ACRE AG&lt;sup&gt;b&lt;/sup&gt; ($)</td>
<td>91</td>
<td>126</td>
<td>97</td>
<td>83</td>
</tr>
<tr>
<td>3. TOTAL MUNICIPAL WATER FARM ACRES&lt;sup&gt;c&lt;/sup&gt;</td>
<td>18,200</td>
<td>0</td>
<td>22,878</td>
<td>11,607</td>
</tr>
<tr>
<td>4. WATER FARM PAV&lt;sup&gt;d&lt;/sup&gt;</td>
<td>1,565,200</td>
<td>0</td>
<td>1,372,680</td>
<td>812,490</td>
</tr>
<tr>
<td>5. WATER FARM PAV AS % OF TOTAL COUNTY PAV&lt;sup&gt;e&lt;/sup&gt;</td>
<td>2.56%</td>
<td>0</td>
<td>0.07%</td>
<td>0.27%</td>
</tr>
<tr>
<td>6. INDEX OF RELATIVE SENSITIVITY OF ASSESSED VALUATION TO CURRENT WATER FARMS&lt;sup&gt;f&lt;/sup&gt;</td>
<td>37</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

<sup>a</sup> Estimates for 1988 based on data from the respective offices of the County Assessors. (See discussion in text.)

<sup>b</sup> Ibid.

<sup>c</sup> Includes all water farm acreage currently owned by municipalities, from Woodard et. al., 1988.

<sup>d</sup> Equal to the average PAV//Acre Ag x Total Municipal Water Farm Acres.

<sup>e</sup> Equal to (Water Farm PAV/Total County PAV from Line 2 of Table 9) x 100.

<sup>f</sup> Equal to the percentage contribution of Water Farm PAV to Total County PAV divided by 0.07%, the value for Pima County.
agricultural land to yield an index of fiscal sensitivity to current municipal water-farming activity. The percentage contribution of Class 4 lands to Total County PAV is weighted by the percentage impact of municipal water farms on Class 4 PAV to yield the relative percentage impact of water-farm purchases on Total County PAV (line 5, Table 10). Again, using Pima County as a base, these percentages are compared among the four counties (line 6, Table 10). This index indicates the relative sensitivity of the county’s property tax base, as measured by PAV, to the purchase of agricultural lands by municipalities. Pinal County’s tax base is shown to be four times more sensitive to current municipal water-farm purchases as is Pima County’s, and La Paz County’s tax base 37 times more sensitive. The index yields a zero for Maricopa County because no municipal water farms have been purchased there.

Impacts on Property Tax Revenues

It is also useful to look at the relative impacts on the county tax base in terms of dollars lost when farm land is removed from the tax rolls. This is accomplished by considering the percentage contribution of agricultural land to property taxes revenues.

Percentage Contribution of Agricultural Land to Property Tax Revenues. A relative measure of the property tax revenue generated per 1,000 acres of agricultural land (Tax Rev/1,000 Acres Ag) is estimated for each county indexed. The 1984 primary and secondary tax rates for each county (lines 1 and 2, Table 11) are applied
### TABLE 11. EFFECT ON PROPERTY TAX REVENUES OF LOSS OF AGRICULTURAL LAND FROM THE TAX BASE

<table>
<thead>
<tr>
<th></th>
<th>LA PAZ</th>
<th>MARICOPA</th>
<th>PIMA</th>
<th>PINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PRIMARY TAX RATE(^a) ($/$100 ASS'D VALUATION)</td>
<td>2.2071</td>
<td>1.5000</td>
<td>4.0312</td>
<td>4.8886</td>
</tr>
<tr>
<td>2. SECONDARY TAX RATE(^b) ($/$100 ASS'D VALUATION)</td>
<td>0</td>
<td>0.1600</td>
<td>0.8268</td>
<td>0</td>
</tr>
<tr>
<td>3. TOTAL TAX REV/1,000 ACRES AG(^c) ($)</td>
<td>1,898</td>
<td>1,462</td>
<td>3,221</td>
<td>3,422</td>
</tr>
<tr>
<td>4. TOTAL COUNTY TAX REV(^d) ($)</td>
<td>1,351,170</td>
<td>99,523,978</td>
<td>102,337,510</td>
<td>14,476,898</td>
</tr>
<tr>
<td>5. TOTAL TAX REV/1,000 ACRES AG AS % OF TOTAL COUNTY TAX REV(^e) ($)</td>
<td>0.1405%</td>
<td>0.0015%</td>
<td>0.0031%</td>
<td>0.0236%</td>
</tr>
<tr>
<td>6. INDEX OF RELATIVE SENSITIVITY OF PROPERTY TAX REVENUES TO LOSS OF AG LAND FROM TAX BASE(^f)</td>
<td>45</td>
<td>0.5</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>7. RELATIVE MEASURE OF TOTAL WATER FARM TAX REV LOST TO COUNTY(^g) ($)</td>
<td>34,546</td>
<td>0</td>
<td>73,684</td>
<td>39,719</td>
</tr>
</tbody>
</table>


\(^b\) Ibid.

\(^c\) Equal to (Primary Tax Rate \times average PAV/Acre Ag from Line 1 of Table 10) \times 1,000.

\(^d\) From Annual Financial Reports of respective counties.

\(^e\) Equal to (Line 3/Line 4) \times 100.

\(^f\) Equal to the percentage contribution of Total Tax Rev/1,000 Acres Ag to Total County Tax Rev divided by 0.0031%, the value for Pima County.

\(^g\) Equal to [(Primary Tax Rate \times average PAV/Acre Ag) + (Secondary Tax Rate \times average SAV/Acre Ag)] \times municipal water farm acreage.
to the average PAV and SAV/Acre Ag, respectively, and multiplied by 1,000. This yields a relative measure of primary and secondary tax revenues per 1,000 acres of agricultural land. The relative measure of total Tax Rev/1,000 Acres Ag is reported on line 3 of Table 11.

Next, the Tax Rev/1,000 Acres Ag are taken as a percentage of total county tax revenues (line 5, Table 11). Again, using Pima County as a base, these values are expressed as an index which measures the relative sensitivity of county property tax revenues to potential municipal water-farming activity (line 6, Table 11). This index shows that the impact on total county tax revenues of the removal of 1,000 acres of agricultural land from the tax base of La Paz County would be 45 times as great as that on Pima County; on Pinal County 8 times as great, and on Maricopa County only half as great.

Revenues Lost From Municipal Water Farms. Finally, a relative measure of total tax revenues lost due to current municipal water-farming activity (Water Farm Tax Rev) is calculated for each county. The 1984 tax rates (lines 1 and 2, Table 11) are applied to the estimated 1988 average PAV and SAV/Acre Ag, respectively, and multiplied by the total number of acres purchased by municipalities in each county. The relative measures of total property tax revenues lost from municipal water farm acreage are given in line 7 of Table 11.

These values do not represent the actual dollars lost by each county because the actual assessed valuation of the land purchased was replaced by a proxy, 1988 average assessed valuation for agricultural lands and multiplied by a 1984 tax rate.
This procedure is compatible with the intent of the calculation, which is to estimate the relative losses of each county, and any errors introduced here should be constant across the counties indexed. It is important, however, not to mistake these values for a calculation of the actual dollar amounts lost.

The value for the relative measure of tax revenues lost is almost twice as high for Pima County as for Pinal and La Paz. This is due primarily to a high tax rate for Pima (nearly twice that of La Paz and second only to Pinal). The values for Pinal and La Paz are similar—in Pinal a higher tax rate (more than double) is applied to lower PAV and SAV/Acre Ag and to fewer total acres than in La Paz. For Maricopa County, where there are no municipal water farms, the value of tax revenues lost is zero.

Impacts on Total County Revenues

Although tax base is an important measure of fiscal capacity, other factors contribute to a county's fiscal well-being. The overall fiscal balance of a county depends also on its sources of revenues other than property taxes. To incorporate these elements, the final part of the direct fiscal index measures the relative impact of water farming on total county revenues. The relative percentage contribution of Water Farm Tax Rev to total county revenues from all sources is determined for each county.

Total County Revenues. Total county revenues (revenues from property taxes and from all other sources) are calculated for fiscal year 1984. County revenues from
sources other than property taxes (line 1, Table 12), as reported in annual county financial reports, are combined with property tax revenues to yield total county revenues from all sources (line 3, Table 12).

Next, Tax Rev/1,000 Acres Ag for each county is taken as a percent of total county revenues (line 4, Table 12). Using Pima County as a base, these percentages are compared among the counties. This index measures the relative sensitivity of total county revenues to the removal of agricultural land from the tax base (line 5, Table 12). As shown by this index, the percentage impact on La Paz County total revenue is 21 times greater than that of Pima County. The impact in Pinal County is 6 times greater, while the percentage impact on Maricopa's total county revenues only one-third as great.

**Summary**

The direct fiscal indices provide a relative measure of two aspects of a county's fiscal capacity: tax base and total county revenues. The first two indices examine the potential impact on the tax base due to municipal water-farm activity, the first in terms of reductions in net assessed valuation and the second in terms of dollars lost. The final index considers the potential impact on total county revenues, again by looking at dollars foregone when agricultural land is acquired by a municipality.
TABLE 12. EFFECT ON TOTAL COUNTY REVENUES OF LOSS OF AGRICULTURAL LAND FROM THE TAX BASE.

<table>
<thead>
<tr>
<th></th>
<th>LA PAZ</th>
<th>MARICOPA</th>
<th>PIMA</th>
<th>PINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. COUNTY REVENUES</td>
<td>4,925,630</td>
<td>264,829,715</td>
<td>120,064,256</td>
<td>26,725,416</td>
</tr>
<tr>
<td>FROM SOURCES OTHER</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>THAN PROPERTY TAXES$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. TOTAL COUNTY</td>
<td>1,351,170</td>
<td>99,523,978</td>
<td>102,337,510</td>
<td>14,476,898</td>
</tr>
<tr>
<td>TAX REVENUES$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. TOTAL COUNTY</td>
<td>6,276,800</td>
<td>364,829,715</td>
<td>222,337,510</td>
<td>41,202,314</td>
</tr>
<tr>
<td>REVENUES FROM ALL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOURCES$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. TAX REV/1,000</td>
<td>0.03%</td>
<td>0.0004%</td>
<td>0.0014%</td>
<td>0.0083%</td>
</tr>
<tr>
<td>ACRES AG AS % OF TOTAL COUNTY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REVENUES$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. INDEX OF SENSITIVITY OF TOTAL COUNTY</td>
<td>21</td>
<td>0.3</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>REVENUES TO LOSS OF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AG LAND FROM TAX ROLLS$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$ Values for fiscal year 1984-85 from Schedule C of the Financial Reports published annually by each county.

b. From Line 6, Table 11.

c. Equal to Line 1 plus Line 2.

d. Equal to (Tax Rev/1,000 Acres Ag from Line 5 of Table 11/Total County Revenues) x 100.

e. Equal to the percentage contribution of Tax Rev/1,000 Acres Ag to Total County Revenues divided by 0.0014%, the value for Pima County.
Impact on Assessed Valuation

The assessed valuation index has two parts. The first part measures the relative vulnerability of the assessed valuation of the entire county to the removal of agricultural lands from the tax rolls, from whatever cause. This can be taken as a measure of the potential severity of the effects on the county tax base from increased municipal water-farming activity.

The second part of this index measures the relative sensitivity of total county assessed valuation to current municipal water farms—the effects captured in the first part of the index are weighted by the relative percentage of cultivated land which has been purchased by a municipality for water. This can be taken as a measure of the relative impact on the county tax base, as reflected by net assessed valuation, of current water-farming activity. The two parts of this index are reported in lines 1 and 2 of Table 13.

Impact on Property Tax Revenues

For the second index, relative impacts on a county's tax base are measured in terms of the dollars foregone when municipal water-farm acreage is removed from the tax rolls. The relative contribution of agricultural lands to total county property tax revenues is assessed. This index measures the relative impact on the county tax base, as reflected by property tax revenues, of potential municipal water-farming activity (line 3, Table 13).
### TABLE 13. SUMMARY OF DIRECT FISCAL INDICES OF RELATIVE SENSITIVITY TO LOSS OF AGRICULTURAL LAND FROM THE TAX BASE

<table>
<thead>
<tr>
<th></th>
<th>LA PAZ</th>
<th>MARICOPA</th>
<th>PIMA</th>
<th>PINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. INDEX OF RELATIVE SENSITIVITY OF ASSESSED VALUATION TO LOSS OF AG LAND FROM THE TAX BASE</td>
<td>1.9</td>
<td>0.7</td>
<td>1.0</td>
<td>2.3</td>
</tr>
<tr>
<td>2. INDEX OF RELATIVE SENSITIVITY OF ASSESSED VALUATION TO CURRENT MUNICIPAL WATER FARM ACTIVITY</td>
<td>37</td>
<td>0</td>
<td>1.0</td>
<td>4</td>
</tr>
<tr>
<td>3. INDEX OF RELATIVE SENSITIVITY OF PROPERTY TAX REVENUE TO LOSS OF AG LAND FROM TAX ROLLS</td>
<td>45</td>
<td>0.5</td>
<td>1.0</td>
<td>8</td>
</tr>
<tr>
<td>4. INDEX OF RELATIVE SENSITIVITY OF TOTAL COUNTY REVENUES TO LOSS OF AG LAND FROM TAX ROLLS</td>
<td>21</td>
<td>0.3</td>
<td>1.0</td>
<td>6</td>
</tr>
</tbody>
</table>

---

*a.* Pima County = 1.0.
Impact on Total County Revenues

The final direct fiscal index considers the percentage contribution of property tax revenues from agricultural land to total county revenues (revenues from property taxes and all other sources combined). This index also measures the relative impact of potential municipal water-farming activity, as reflected by total county revenues. This final index is reported in line 4 of Table 13.
CHAPTER 11

CONCLUSIONS AND POLICY IMPLICATIONS

Results of Indices

Taken alone, the indices of relative sensitivity to water farming paint a provocative picture. The indices show that the very counties where the majority of water farming activity is occurring tend to be most sensitive to the negative impacts. The relative measures of dollar losses and percentage impacts, both economic and direct fiscal, are reported for potential and current demand for water farms in Tables 14 and 15, respectively.

Economic Impacts

The relative percentage economic impacts of potential water farming activity are shown to be much larger for La Paz County than for any other county indexed (79 times greater than for Pima County, with Pinal 45 times greater, and Maricopa only four times as great) (line 2, Table 14). This is true even though the relative measure of income loss due to retirement (line 1 of Table 14) shows La Paz County to have the lowest per acre loss. Conversely, Maricopa County suffers the highest actual economic impact from the retirement of its own agricultural land for water farms, but only the second lowest potential impact from expansion of water farming in the county (only four times as high as Pima County, one-twentieth the impact felt in La Paz, and one-eleventh the impact felt in Pinal). This is because the income generated per acre of agricultural land in La Paz County, even though less than in
TABLE 14. SUMMARY OF RELATIVE MEASURES OF DOLLAR LOSSES AND PERCENTAGE IMPACTS DUE TO POTENTIAL DEMAND FOR WATER FARMS.\textsuperscript{a}

<table>
<thead>
<tr>
<th></th>
<th>LA PAZ</th>
<th>MARICOPA</th>
<th>PIMA</th>
<th>PINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. IMPUTED LOSS IN AG-RELATED INCOME PER ACRE OF AG LAND RETIREDb</td>
<td>$284</td>
<td>$655</td>
<td>$442</td>
<td>$392</td>
</tr>
<tr>
<td>2. INDEX OF RELATIVE SENSITIVITY OF COUNTY INCOMES TO DECLINES IN AGRICULTURE</td>
<td>79</td>
<td>4</td>
<td>1</td>
<td>45</td>
</tr>
<tr>
<td>3. INDEX OF RELATIVE SENSITIVITY OF ASSESSED VALUATION TO LOSS OF AG LAND FROM TAX BASE</td>
<td>1.9</td>
<td>0.7</td>
<td>1</td>
<td>2.3</td>
</tr>
<tr>
<td>4. RELATIVE MEASURE OF TOTAL TAX REVENUE LOST PER 1,000 ACRES OF AG LAND LOST FROM TAX BASE</td>
<td>$1,898</td>
<td>$1,462</td>
<td>$3,221</td>
<td>$3,442</td>
</tr>
<tr>
<td>5. INDEX OF RELATIVE SENSITIVITY OF PROPERTY TAX REVENUES TO LOSS OF AG LAND FROM TAX BASE</td>
<td>45</td>
<td>0.5</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>6. INDEX OF RELATIVE SENSITIVITY OF TOTAL COUNTY REVENUES TO LOSS OF AG LAND FROM TAX BASE</td>
<td>21</td>
<td>0.3</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Pima County = 1.0.

\textsuperscript{b} Equal to Line 4 of Table 6 divided by Line 2 of Table 6.
TABLE 15. SUMMARY OF RELATIVE MEASURES OF DOLLAR LOSSES AND PERCENTAGE IMPACTS DUE TO CURRENT DEMAND FOR WATER FARMS.\(^a\)

<table>
<thead>
<tr>
<th></th>
<th>LA PAZ</th>
<th>MARICOPA</th>
<th>PIMA</th>
<th>PINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. IMPUTED LOSS IN AG-RELATED INCOME DUE TO RETIREMENT OF WATER FARM ACREAGE ($1,000)</td>
<td>6,780</td>
<td>22,949</td>
<td>10,332</td>
<td>12,378</td>
</tr>
<tr>
<td>2. INDEX OF RELATIVE SENSITIVITY OF COUNTY INCOME TO CURRENT DEMAND FOR WATER FARMS</td>
<td>39</td>
<td>0.7</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>3. INDEX OF RELATIVE SENSITIVITY OF ASSESSED VALUATION TO CURRENT DEMAND FOR WATER FARMS</td>
<td>37</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>4. RELATIVE MEASURE OF TOTAL TAX REVENUE LOST DUE TO CURRENT DEMAND FOR WATER FARMS</td>
<td>$34,546</td>
<td>0</td>
<td>$73,684</td>
<td>$39,719</td>
</tr>
</tbody>
</table>

\(^a\) Pima County = 1.0.
the other counties indexed, represents a larger portion of the county's total income. Similarly, agricultural-related income per acre of farm land in Pinal County is the second lowest, while the sensitivity of total county incomes in Pinal to declines in agriculture is second highest. This index measures the relative impact of reductions of agricultural acreage from whatever cause, yielding a relative measure of the sensitivity of each county to potential water farming activity.

The index reported in line 2 of Table 15 combines the dependence of county incomes on agriculture with the intensity of current water farming activity. This index shows La Paz's sensitivity to current demand for water farms to be 39 times greater than Pima's, Pinal's 10 times greater, and Maricopa's only 0.7 times as great. Again, the relative measure of declines in agricultural-related income due to current water farming activity (reported in line 1 of Table 15) shows the dollar losses for Maricopa County to be more than three times as great as for La Paz County, even though the relative impact of current water farming activity on total county income in La Paz is 56 times greater than in Maricopa.

When constructing the economic index, the effects on county incomes of retirement of irrigated acreage was calculated without introducing a compensating value for the unquantified but large economic benefits of future development on the retired lands. It is most likely that retired farm land in the Phoenix and Tucson metropolitan areas will eventually be included in urban developments, readily offsetting any declines in county income that result from the retirement of irrigated acreage. Retired farm land in Pinal County also may move into high economic-
valued alternative uses. Although less certain, this is possible in Pinal, particularly if an "urban corridor" does eventually connect the state's two metropolitan areas. In La Paz County, however, given the lack of foreseeable opportunities, it is doubtful whether retired farm land will move into alternative uses, particularly absent plentiful water to attract new development. While these potential benefits would need to be quantified and included in any assessment of future development potential, the likelihood of alternative development in Maricopa, Pima, and possibly Pinal counties, and the lack of foreseeable options in La Paz, tend to support rather than contradict the direction of the economic index developed here.

Direct Fiscal Impacts

In general, the direct fiscal indices show that while dollar losses to county governments are small, their relative importance to county revenues is much greater in La Paz and Pinal than in Pima and Maricopa counties. As was the case with the economic index, the direct fiscal indices demonstrate that the counties most vulnerable to potential fiscal impacts are experiencing the most intense water farming activity.

Assessed Valuation. The assessed valuation index (line 3 of Table 5) indicates that the percent impact of current municipal water farming on the tax base is 37 times greater in La Paz County than in Pima County; in Pinal County the percent impact is four times greater. La Paz County's extreme sensitivity is due to the large percentage contribution of municipal water farm acreage to the county's assessed
valuation—because only five percent of county lands in La Paz are privately held, the 18,200 acres owned by municipalities constitute a significant portion of the original tax base. The index value for Maricopa County is zero, reflecting the lack of a market for municipal water farms in Maricopa County. Even if Maricopa County were to experience considerable municipal water farming activity, it probably would not exhibit extreme sensitivity to direct fiscal impacts because the contribution of agricultural land to total county assessed valuation is moderate.

In La Paz County, while the relative percentage impact on county income of potential water farming activity was shown to be much larger than for any other county indexed (line 2, Table 14), the relative sensitivity of assessed valuations to potential municipal water farms is not correspondingly large (1.9 times greater than Pima, compared to Pinal's 2.3 and Maricopa's 0.8) (line 3, Table 15). This reflects that, while agriculture contributes a proportionally higher amount to county incomes in La Paz than in the other counties, the proportional contribution of agricultural land to county-wide assessed valuations is not correspondingly significant. This is because most of the agricultural activity in La Paz occurs on the Colorado River Indian Reservation. As a sovereign nation, the Colorado River Indian Tribes are not subject to taxation by other governments. Therefore, reservation land or economic activity on the reservation (even when non-Tribal members participate) do not contribute directly to county tax revenues. However, because reservation lands cannot be sold as water farms, the fact that most farming is done on-reservation protects the county somewhat from future water farming activity. This does not
The tribes' water entitlement may not be leased to off-reservation, out-of-county water users some time in the future. If this were to occur, La Paz County could expect to experience further economic impacts due to the retirement of irrigated farm land on the reservation. No further direct fiscal impacts would be experienced, however, because reservation lands are not part of La Paz County's tax base.

County Revenues. The magnitude of the relative losses to county revenues from municipal water farming activity (reported on line 4 of table 15) clearly shows that dollar losses to county governments from municipal water farm purchases are small, especially when compared to total property tax revenues and to county revenues from all sources combined. However, even though the dollar losses due to the removal of 1,000 acres of agricultural land from the tax base are second smallest for La Paz County, their relative importance to county revenues is much greater than in Pima and Maricopa counties. Line 5 of Table 14 shows that the impact on La Paz County's total tax revenues of the removal of 1,000 acres of agricultural land from the tax base would be 45 times as great as on Pima County, on Pinal County eight times as great, and on Maricopa County only half as great. The percentage impact on county revenues from all sources combined (line 6 of Table 14) is shown to be 21 times greater in La Paz than in Pima, six times greater in Pinal, and only one-third as great in Maricopa.

\[141\] Note that these values are not estimates of actual losses and should not be mistaken as such. Refer to discussion in Chapter 10 for further details.
Low-Impact Alternatives

The absolute value of imputed losses in agriculture-related incomes per acre of farm land retired in Maricopa County is considerably higher than for any of the other counties indexed. However, even while Maricopa County suffers the highest actual economic impact from the retirement of its own agricultural land for water farms, the percentage impact on county incomes is much lower than for any county other than Pima. The municipalities, developers, and investors most active in the purchase of water farm acreage are located in Maricopa County. Water providers in the Phoenix area wish to import water from other areas in part because agricultural acreage tends to be more expensive in Maricopa County (although transport costs are correspondingly lower). The primary reason, however, is that irrigated acreage retired within the Phoenix AMA does not add to the AMA's total assured water supply under the Groundwater Management Act. The legal requirements intended to bring water demand in the Phoenix area into balance with its renewable water resources may instead have driven Maricopans to impose disproportionate costs on rural Arizonans to provide for continued growth in the Phoenix metropolis. This suggests that policy makers may wish either to investigate means of compensating the rural counties for their disproportionate sacrifice, or to reconsider the terms of the Groundwater Management Act that create the primary disincentive for retirement of local lands.
The City of Tucson, on the other hand, at one time planned to purchase and retire virtually half of Pima County's irrigated acreage during the coming decades. While this policy may create inequities among Pima County communities which are obscured by viewing the county as a whole, on a county-by-county basis Tucson's practice of acquiring local water supplies appears to inflict the lowest regional economic impacts of the alternative sources indexed here. Pima County also shows a relatively low vulnerability to the direct fiscal effects of municipal water farms. Tucson has lobbied state policy makers to modify the way in which basin accounts are calculated to allow credit for the local groundwater rights the City has acquired and not yet used. The economic and fiscal sensitivities reported here might be seen as supporting this policy as a means to encourage or reward the low-impact alternative for augmenting water supplies. Other water interests in the state oppose such a policy, however, due to concerns that it would undermine the intent of the GWMA.

Mitigation of Direct Fiscal Impacts

The direct dollar losses to county governments when municipal water farm acreage is removed from the tax rolls are small, especially when compared to the huge investments which municipalities are willing to make to secure additional water supplies. This suggests that these losses easily could be compensated by the purchasing municipalities. Indeed, there seems to be agreement among most water interests in the state that direct losses to the county and to most other taxing
authorities should be mitigated. Agreement is lacking, however, over how mitigation should be accomplished.

In general, three key issues remain unresolved concerning mitigation of direct fiscal impacts: (1) the voluntary nature of in-lieu tax payments, (2) the method of appraising water farm acreage, and (3) the process to be followed when a dispute arises between the local government and a municipal water farm owner.

Voluntary Payments. The voluntary nature of in-lieu tax payments poses several problems for rural governments confronted with municipal water farm purchases. Most obvious, municipal water farm owners may choose not to make any payments in lieu of taxes. Second, even when municipal governments are willing to make voluntary contributions, rural governments possess little leverage with which to negotiate favorable terms of payment. Perhaps most important, however, voluntary payments provide no guarantee that municipalities will continue to make payments into the future.

The current political controversy surrounding water farming makes city councils generally willing to make voluntary payments, perhaps in large part to avoid the negative public perception of declining to do so. The future willingness to make payments, however, is doubtful at best. This is particularly true given that many municipalities are buying rural water farms to comply with the assured water supply provisions of the GWMA, rather than to satisfy a current need for additional water. If today's water farms later are found to be unnecessary for meeting municipal water
demand, it is unlikely that future city councils could justify making continued voluntary payments to rural counties.

This leaves rural governments in the position of asking for voter approval of capital improvements without being able to guarantee the terms of debt repayment. If property is removed from the tax base, thereby reducing the county's net assessed valuation, the tax rate (calculated per $100 of assessed valuation) must be increased to the remaining tax payers in order to meet repayment obligations. The water farm purchases by Phoenix and Scottsdale, for example, effectively raised La Paz County's property tax rate 0.02 cents.\textsuperscript{142} The effects on special district levies can be even more severe as large water farm purchases concentrate the impacts locally.

**Appraising Water Farms.** Controversy persists regarding the method to be used when appraising water farm acreage for purposes of determining payments to county governments by municipal and private water farm owners. As discussed earlier, the assessment of agricultural property contains a double subsidy—an artificially depressed land valuation combined with a low assessment ratio. At issue is whether water farms should continue to be assessed as regular farm land. Many contend that water farms should be assessed based on fair market value, rather than on the income basis used for agricultural land, and that a special assessment ratio be established for land held primarily for the water rights. It can be argued, for example, that water farms more closely resemble Class 1 and 2 lands (with assessment ratios of 30 percent), which include producing mines, mining claim

\textsuperscript{142} Personal communication with Neta Bowman, La Paz County Manager, 1988.
property, and property used to provide local telecommunications service, gas, water, and electric.

If new assessment ratios and valuation methods are established, an important consideration might be whether irrigation is retired on water farm acreage. Maintaining agricultural valuations and assessment ratios on water farm acreage which continues to be irrigated could provide an important incentive for water farm owners to maintain agricultural production on the land, thereby reducing the economic effects of retirement.

Dispute Resolution. An additional unresolved issue surrounding in-lieu tax payments involves the lack of established guidelines for resolving disputes. Municipalities and county governments attempting to negotiate in-lieu tax payments would benefit substantially from formal guidelines. Currently, disputes often result in delayed payments, or no payments at all, to county governments.

A recent controversy between Phoenix and La Paz County officials illustrates the need to resolve these issues. In 1987, Phoenix elected to make in-lieu payments in 1988 on its McMullen Valley water farm and was subsequently billed by La Paz County. The appraisal was based on the income approach customary for agricultural lands--$200 to $300 per acre, and the 16 percent agricultural assessment ratio was applied. In 1988, however, when Phoenix agreed to make in-lieu payments again in 1989, La Paz County Assessors reappraised the 14,000 acres. This time the water farm was appraised based on fair market value, using Phoenix's purchase price (an average of $2,180 per acre) as fair market value. The reappraisal increased the levy
from $5.8 million for 1988 to $28.8 million for 1989. Phoenix city officials balked when La Paz County billed them $265,000, an increase of more than 200 percent from their 1988 payment. The Phoenix city council voted not to make this payment, and instead authorized an in-lieu payment equal to the 1988 payment of $80,000 plus 10 percent. Phoenix contends the 200 percent rate increase is unwarranted and that its property is not being treated the same as other agricultural properties, even though the 16 percent agricultural assessment ratio still was employed. While this may be true, Phoenix's property is being treated the same as other water farm acreage in La Paz, all of which was reappraised the same year based on fair market value. Furthermore, La Paz County's attorney maintains that once Phoenix agrees to make the payment, it is required to follow statutory procedures and cannot unilaterally alter the amount or withhold payment.

The amount of the in-lieu tax payment remains in dispute, and the Arizona Department of Revenue has intervened to reappraise the property. While it is likely the levy ultimately will be reduced to last year's rate, the actions by the county assessors drew attention to the issue of who should classify water farm acreage and how it should be done. Furthermore, the controversy demonstrates the need for mandatory guidelines for resolving disputes over in-lieu tax payments.

Other Taxing Authorities

Taxing authorities other than county governments are affected by municipal water farms. While only the sensitivity of county governments was indexed to
facilitate cross-county comparisons, impacts on other taxing authorities, such as school districts and other special districts, could be the most severe. This is because the effects of municipal water farm purchases are concentrated in small geographic areas. Phoenix's purchase of 14,000 acres in the McMullen Valley, for example, caused the Wenden Fire District to lose over 50 percent of its tax base. While losses to other local districts were not as severe, impacts were still substantial. See Table 16 for a summary of impacts on other local taxing authorities in the McMullen Valley.

Fiscal Growth Potential

Discussions of compensating for the removal of municipal water farms from the tax rolls generally fail to address the broader concerns of rural governments. While general agreement exists on the need to compensate direct fiscal impacts, scant attention has been paid to the indirect and induced fiscal impacts of water farming. For the most part, county governments are more concerned with the effects of municipal purchases on the economic development of the county and the local government's future power to govern than they are with the actual revenues currently lost from municipal water farms.

To the extent that municipal ownership of county land undermines local taxing authority and inhibits the movement of land into higher economic-value alternative uses, it erodes the county's power to govern. Municipal purchases potentially undermine the local government's future growth potential through the loss of current
TABLE 16. IMPACTS ON ASSESSED VALUATIONS OF SCHOOL AND SPECIAL DISTRICTS IN McMULLEN VALLEY

<table>
<thead>
<tr>
<th>LOCAL DISTRICT</th>
<th>PERCENTAGE LOSS OF ASSESSED VALUATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wenden Elementary School District</td>
<td>9.8%</td>
</tr>
<tr>
<td>Salome Elementary School District</td>
<td>1.8%</td>
</tr>
<tr>
<td>Bicentennial Union High School</td>
<td>2.7%</td>
</tr>
<tr>
<td>Arizona Western College</td>
<td>1.9%</td>
</tr>
<tr>
<td>Salome Fire District</td>
<td>5.0%</td>
</tr>
<tr>
<td>Wenden Fire District</td>
<td>55.8%</td>
</tr>
</tbody>
</table>
property tax revenues, but more important, through the loss of future revenues and economic opportunity.

The assessed valuation index (line 3, Table 14) provides a useful tool for policy makers to assess the direct fiscal impact on a rural county when its future development potential is adversely affected by municipal water farming. As economic development of a county moves lands into higher valuation classifications, Class 4 lands are the most likely to move up because they currently represent the lowest economic category. This is because agricultural land is valued on an income rather than a fair market basis, and also because it has a lower assessment ratio than most other real property (refer to Table 8). Commercial and residential property, on the other hand, is both valued differently and assessed at a higher rate than agricultural land. Agricultural land, therefore, as a use class contributes a smaller percentage of its value to the real property portion of a county's assessed valuation. To the extent that this is true, Class 4 lands represent the greatest potential increase to tax revenues generated from real property as a county develops.

Assessing the impact of water farming on a county's development potential is extremely difficult because it generally involves making predictions about the future. This index, however, does not attempt to predict future development. Instead, it considers the degree to which lands which have the potential to move into higher tax brackets are frozen into current assessments and valuations due to ownership by tax exempt entities. The percentage of a county's assessed valuation based on Class 4 lands could be considered an important measure of the impact of water farming on
the county governments fiscal growth potential. Seen in this light, the proportionally
greater reliance of county tax base on Class 4 lands in La Paz and Pinal counties (see
line 3, Table 9) indicates a greater vulnerability in these counties to limitations on
the growth of county fiscal capacity. In contrast, the potential limitations on the
growth of Pima County's fiscal capacity is minimal, and the growth in fiscal capacity
of Maricopa is unlikely to be impaired.

This aspect of Class 4 lands raises important questions regarding tax policies
affecting privately owned water farm acreage as well as that owned by municipalities.
Privately owned water farms affect a county's fiscal growth potential to the extent
that alternative development of the land is excluded. Under current tax policy,
privately owned water farm acreage continues to be valued and assessed as
agricultural land, even though the primary purpose of ownership is no longer to
realize a profit from growing crops.\textsuperscript{143}

\textbf{Policy Challenges}

Water transfer policies which take into account third party effects are justified
on both efficiency and equity grounds. Because the adverse effects of water transfers
represent costs to society, inclusion of all third party effects in water transactions
ensures that transfers which do not produce a net economic benefit to society will be

\textsuperscript{143} Although agricultural land primarily is defined by use, the statutory definition,
among other things, states that the primary function of the property is to produce an
agricultural crop or commodity, and that the property is used with a reasonable expectation
of profit solely from its agricultural use (emphasis added).
precluded. Even when economic efficiency criteria are satisfied, some water transfers still are undesirable from an equity perspective. The economic and fiscal indices presented here highlight the inequities of water policies which both allow and encourage the areas of the state least vulnerable to the adverse effects of water farming to seek supplemental water supplies in the areas of the state which are most vulnerable.

These disproportionate costs to rural Arizona perhaps could be justified if outweighed by some essential benefit to the state as a whole. However, the statewide benefits of mining the groundwater supplies of one part of the state to preserve those of another remain unclear. The underlying question concerning water farming is whether Arizona's urban centers should be encouraged to grow and prosper at the expense of rural Arizona.

In addition to protecting third parties, transfer policies are desirable to provide security. Security is important not only for areas of origin and other water right holders, but also for urban water providers seeking to augment supplies. Current state water policies make new development in certain areas contingent on the acquisition of water supplies to serve the new use for 100 years; it seems to follow that the state has a responsibility to outline the conditions under which this can be accomplished.

Water transfers, as a means to reallocate water supplies within the state, have the potential to provide tremendous benefits to Arizonans. Most important, they promote flexibility in water use by allowing water to move to alternative uses as
economic conditions change or as new public values in water are recognized. At the same time, as shown by the indices, transfers potentially can inflict disproportionate costs on third parties. Furthermore, the absence of clear transfer policies and procedures creates a climate of uncertainty in which current water right holders, third parties, and potential transferrors all lack the security needed to plan for and invest in the future.

Effective water transfer policies should be aimed at promoting flexibility in water use while providing security to water right holders, areas of origin, and potential transferrors. Because these two goals usually conflict, Arizona policy makers are left with the difficult challenge of finding the desired balance between promoting water transfers and protecting vulnerable interests. The economic and fiscal indices developed in this work provide a useful tool for identifying the interests most vulnerable to the adverse effects of water farming. Ideally, water transfer policies should reflect the concerns of all affected parties and result in transfers that benefit a wide range of Arizona's water users.
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